

United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
the United States
Department of
Agriculture, Forest
Service; Michigan
Department of
Agriculture; Michigan
Agricultural Experiment
Station; and Michigan
Technological University

Soil Survey of Ogemaw County, Michigan



How To Use This Soil Survey

General Soil Map

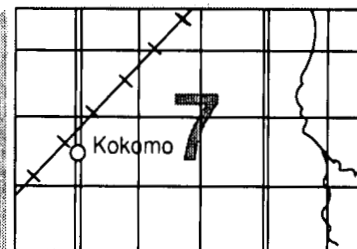
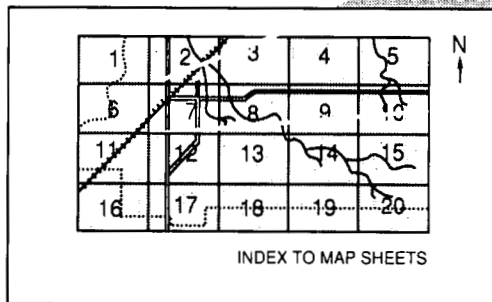
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

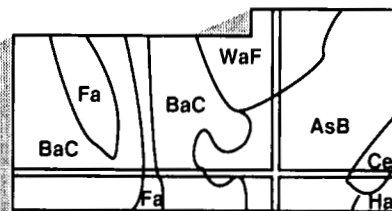
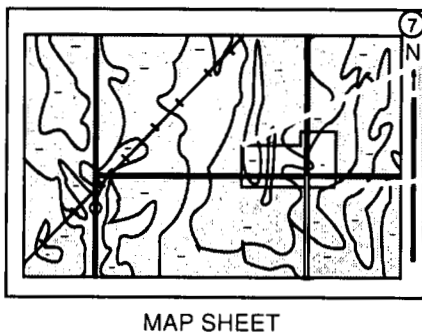
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service, Forest Service, Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University. It is part of the technical assistance furnished to the Ogemaw County Soil Conservation District. Financial assistance was made available by the Ogemaw County Board of Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Dairy farming in an area of the Nester-Kawkawlin association. The woodland in the background is in an area of the Graycalm-Montcalm-Klacking association.

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Foreword

This soil survey contains information that can be used in land-planning programs in Ogemaw County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Homer R. Hilner
State Conservationist
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Location of Ogemaw County in Michigan.

Soil Survey of Ogemaw County, Michigan

By Erik P. Johnson, Michigan Department of Agriculture

Fieldwork by Joseph K. Calus, Robert E. Evon, Jon Quisler, and Joseph R. Dumont, Soil Conservation Service; Erik P. Johnson and Said Mahjoory, Michigan Department of Agriculture; and Karl E. Pregitzer, Forest Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with
the Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University

OGE MAW COUNTY is in the northeast quarter of the Lower Peninsula of Michigan. The county is bordered on the north by Oscoda County, on the east by Iosco County, on the west by Roscommon County, and on the south by Arenac and Gladwin Counties. Ogemaw County covers an area of 368,064 acres, or about 576 square miles. About 66 percent of the acreage in the county is forested, 23 percent is used for agriculture, and 11 percent is in other uses, including recreation and transportation. West Branch, the county seat, has a population of about 1,785.

Farming is the main enterprise in the county. Timber production, natural gas and oil production, manufacturing, and tourism are also important.

Soil scientists have determined that there are about 45 kinds of soil in Ogemaw County. The soils range widely in texture, natural drainage, slope, and other characteristics.

This soil survey updates the survey of Ogemaw County published in 1928 (14). The present survey provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about

Ogemaw County. It describes history and development, physiography, lakes and streams, farming, industry and transportation facilities, and climate.

History and Development

Ogemaw County was part of several counties in the early 1800's and was established as a separate county in 1875 (3). West Branch, the county seat, was incorporated in the early 1900's.

The county was originally inhabited by the Chippewa Indians. Its name is from Ogemaw-Ke-Ke-To, Chief Speaker of the Chippewas.

Like most counties in the northern part of Michigan, Ogemaw County has a major lumbering industry. The lumbering era began about 1870 and slowed by 1910. After the timber was harvested, many pioneers moved into the area. They cleared the land and established farms.

Dairy farming, timber harvesting, industry, and tourism are now the mainstays of Ogemaw County's economy.

Physiography

Most of the topographic features of the county are a result of erosion or deposition during the Wisconsin

Glaciation, the last glacial period. The part of the glacier that covered Michigan began to recede about 14,000 years ago and moved completely out about 8,000 years ago. The glacial drift that was left as the ice melted covered the entire county to a depth of several hundred feet. It formed such topographic features as moraines, till plains, outwash plains, kames, and glacial drainageways.

The main physiographic feature of the county is the West Branch Moraine, which divides the west-central part of the county from the northeast part. This area rises several hundred feet above the surrounding areas. The area is steep and has deep natural drainageways throughout.

The dominant feature of the northwest part of the county is the St. Helen Plain, which is a nearly level, sandy outwash plain.

The Sage Lake knolls are a rolling to steep morainic system in the east-central part of the county. Moraines in the southwest part of the county generally are undulating to rolling.

A nearly level to undulating till plain is in the southeast part of the county. The Rifle River flows through part of a large glacial outwash valley. Many of the lakes in the county are glacial in origin.

The elevation of Ogemaw County is 850 to 1,400 feet above sea level.

Lakes and Streams

The county has about 6,000 acres of scattered lakes and ponds (fig. 1). These water areas range from less than 5 acres to more than 700 acres. Some lakes are in marshes and exhibit all stages of filling by vegetation. Most of the lakes are in the eastern half of the county. Among the larger ones are Sage Lake, 780 acres; Au Sable Lake, 270 acres; South Dease Lake, 270 acres; Peach Lake, 210 acres; Rifle Lake, 180 acres; and George Lake, 180 acres. Ogemaw County has four major drainage systems—the West Branch of the Rifle River, the Rifle River, the Au Gres River, and the Tittabawassee River.

The Rifle River and the West Branch of the Rifle River drain the central and west-central parts of the county. The headwaters are in Rose Township. The Rifle River flows south and leaves the county in Mills Township.

The Au Gres River drains the east-central part of the county. It flows southeast from Sage Lake and leaves the county in Logan Township.

The Tittabawassee River and its tributaries drain the southwest part of the county. The river flows south and

leaves the county in Edwards Township.

Farming

Farming in Ogemaw County began around 1870, about the same time as the lumbering era (3). Between 1870 and 1900, settlers cleared the land and established farmsteads. Farming was practiced mainly on the loamy soils in the central part of the county. The early farmers grew corn, oats, potatoes, and wheat. Most of the farms now rely on dairy production.

The good cropland in the central, southeast, and southwest parts of the county is farmed. According to recent statistics, there is 67,380 acres of cropland (5). Most of the crops grown in the county are used as livestock feed in dairy operations (fig. 2). Grasses and legumes are grown for pasture.

The Ogemaw County Soil Conservation District was formed in 1951 to assist landowners in controlling soil erosion and pollution.

Industry and Transportation Facilities

The major manufacturing operations in Ogemaw County are related to building products, automobile products, oil refining, and timber products.

Coarse sand and gravel in many areas of the county are important sources of roadfill. Many oil and gas wells are in scattered areas throughout the county.

The only airport in the county is just east of the city of West Branch. One railroad freight line serves the county. One U.S. highway and three state highways link Ogemaw County with all points in the state.

Climate

Prepared by the Michigan Department of Agriculture, Climatology Division, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at West Branch and Lupton in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 20.3 degrees F, and the average daily minimum temperature is 11.6 degrees. The lowest temperature on record, which occurred at West Branch on February 10, 1912, is -36 degrees. In summer the average temperature is 65.8 degrees, and the average daily maximum temperature is 78.4 degrees. The highest recorded temperature, which occurred at West Branch on July 13, 1936, is 107 degrees.



Figure 1.—The many lakes in the county attract tourism.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 28.87 inches. Of this, 17.2 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14.4 inches. The heaviest 1-day rainfall during the period of record was

4.36 inches at West Branch on October 3, 1954.

Thunderstorms occur on about 32 days each year in June, July, and August.

The average seasonal snowfall is about 57 inches. The greatest snow depth at any one time during the period of record was 46 inches on February 17 and 18, 1905. On the average, 95 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year and from area to area. It ranges from a low of 82 days in the southeastern part of the county to a high of 110 days in the northwestern part.

The heaviest snowfall was 95 inches in the winter of 1951-52, and the lightest snowfall was 30.1 inches in

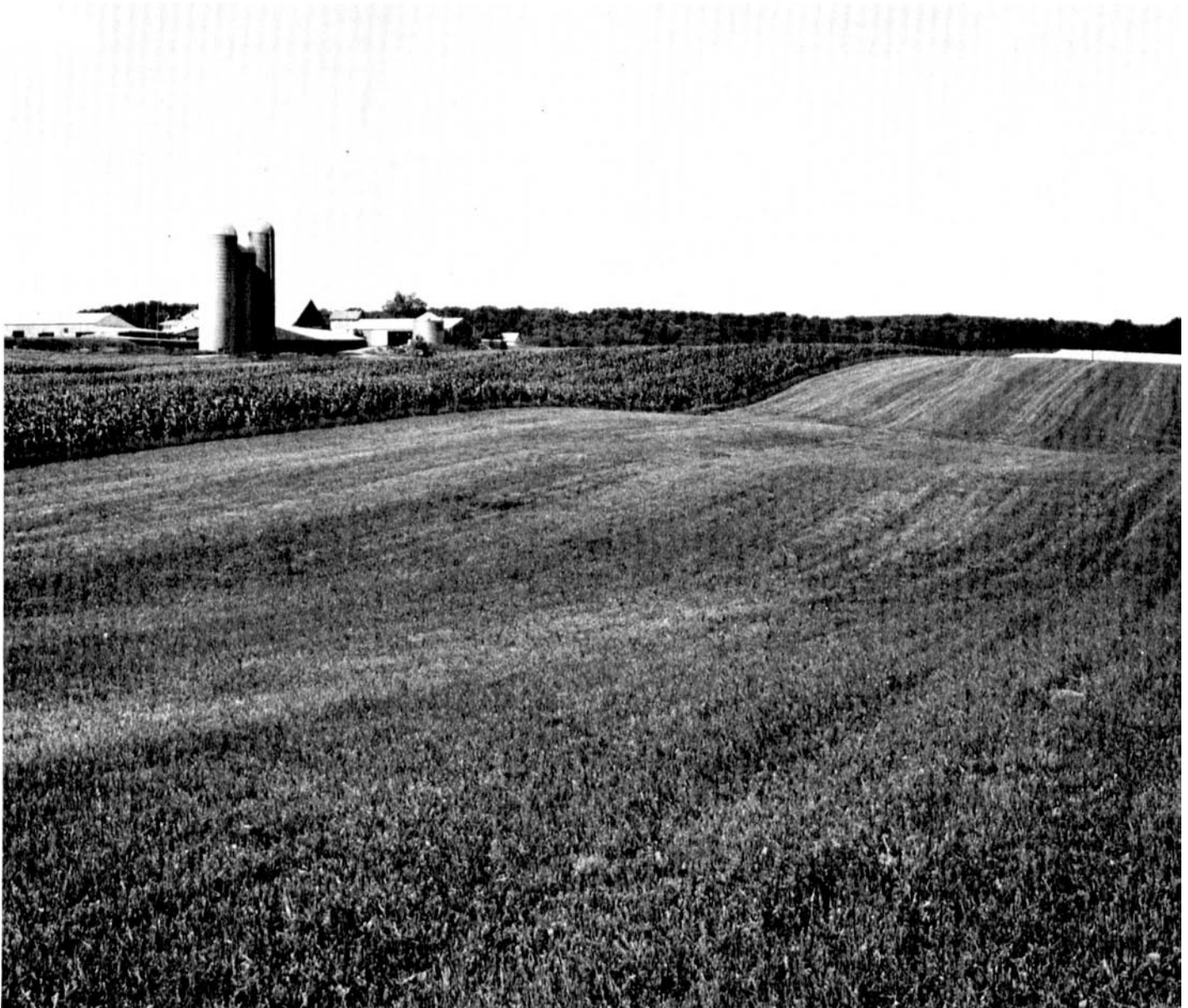


Figure 2.—A typical dairy rotation of alfalfa hay and corn in an area of Nester and Kawkawlin soils.

the winter of 1963-64. The heaviest 1-day snowfall on record was more than 14 inches on February 14, 1911.

The average relative humidity in midafternoon is about 64 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 65 percent of the time possible in summer and 36 percent in winter. The prevailing wind is from the southwest, and the average windspeed is 8.9 miles per

hour. Average windspeed is highest, 10.1 miles per hour, in January.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a

discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data

based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes.

Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit

descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some of the boundaries on the general soil map of Ogemaw County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences are the result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts. Also, some differences are the result of variations in the intensity of mapping or in the extent of the soils within the counties.

Soil Descriptions

Nearly Level to Steep, Somewhat Excessively Drained and Excessively Drained Soils

These soils generally are used as woodland. The major concerns in managing woodland are seedling mortality and the equipment limitation. The major soils are generally unsuited to use as cropland and are poorly suited or unsuited to pasture. Droughtiness is the major concern.

1. Graycalm-Grayling Association

Nearly level to steep, somewhat excessively drained and excessively drained, sandy soils on outwash plains

This association is on broad plains and narrow ridges in the uplands. Slope ranges from 0 to 35 percent.

This association makes up about 10 percent of the county. It is about 55 percent Graycalm soils, 35 percent Grayling soils, and 10 percent soils of minor extent.

The Graycalm soils are nearly level to steep and are somewhat excessively drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick.

The Grayling soils are nearly level to steep and are excessively drained. Typically, the surface layer is very dark grayish brown sand about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, very friable sand about 25 inches thick. The substratum to a depth of about 60 inches is brownish yellow and very pale brown sand.

The most common soils of minor extent are the well drained Klacking and Manistee soils. These soils are in landscape positions similar to those of the major soils.

This association is used mainly as woodland and wildlife habitat. Where these soils are used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. These soils are poorly suited or unsuited to use as cropland and are moderately well suited, poorly suited, or unsuited to pasture. The major management concerns are droughtiness, the organic matter content, and soil blowing.

The major soils are well suited or moderately well suited to building site development.

Nearly Level to Very Steep, Excessively Drained, Somewhat Excessively Drained, Somewhat Poorly Drained, and Poorly Drained Soils

These soils are used as woodland in most areas. The major management concerns are the equipment

limitation, seedling mortality, plant competition, and the windthrow hazard. A few areas are used as cropland or pasture. The major soils are moderately well suited or poorly suited to use as cropland and are well suited, moderately well suited, or poorly suited to pasture. Droughtiness, wetness, the hazard of water erosion, and soil blowing are management concerns in the areas used for crops or pasture.

2. Graycalm-Rubicon-Mancelona Association

Nearly level to very steep, somewhat excessively drained and excessively drained, sandy soils on moraines and outwash plains

This association is on broad plains, knolls, and ridges in the uplands. Slope ranges from 0 to 50 percent.

This association makes up about 16 percent of the county. It is about 40 percent Graycalm soils, 15 percent Rubicon soils, 10 percent Mancelona soils, and 35 percent soils of minor extent.

The Graycalm soils are nearly level to steep and are somewhat excessively drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick.

The Rubicon soils are nearly level to very steep and are excessively drained. Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of about 60 inches is light yellowish brown and yellowish brown sand.

The Mancelona soils are nearly level to very steep and are somewhat excessively drained. Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown very gravelly sand, gravelly sand, and sand.

The soils of minor extent are the well drained Manistee soils, the somewhat poorly drained Colonville soils, and the very poorly drained Lupton soils.

Manistee soils are underlain by clayey material. They are in landscape positions similar to those of the major soils. Colonville soils are along the major streams and rivers in this association. Lupton soils are in depressions and natural drainageways.

These soils are used mainly as woodland. In some areas they are used as cropland or pasture.

The major management concerns in the areas used as woodland are the equipment limitation, seedling mortality, and plant competition. Water erosion is a hazard on the steeper slopes.

Because of droughtiness, the major soils are moderately well suited, poorly suited, or unsuited to crops and are well suited, moderately well suited, or poorly suited to pasture. The major management concerns are soil blowing, droughtiness, the organic matter content, and the slope.

The main limitation in the areas of this association used for building site development is the slope.

3. Rubicon-Au Gres-Roscommon Association

Nearly level to rolling, excessively drained, somewhat poorly drained, and poorly drained, sandy soils on outwash plains

This association is on knolls and ridges and in depressions and low lying areas. Slope ranges from 0 to 18 percent.

This association makes up about 7 percent of the county. It is about 30 percent Rubicon and similar soils, 20 percent Au Gres soils, 20 percent Roscommon soils, and 30 percent soils of minor extent.

The Rubicon soils are nearly level to rolling and are excessively drained. Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of about 60 inches is light yellowish brown and yellowish brown sand.

The Au Gres soils are nearly level and somewhat poorly drained. Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is pale brown, mottled sand about 3 inches thick. The subsoil is about 23 inches thick. The upper part is strong brown, very friable sand. The lower part is yellowish brown, loose sand. The substratum to a depth of about 60 inches is light yellowish brown and light brownish gray sand.

The Roscommon soils are nearly level and poorly

drained. Typically, the surface layer is black mucky sand about 5 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown sand.

The most common soils of minor extent are well drained soils on upland knolls and ridges.

Most areas of this association are used for woodland, recreation, or wildlife habitat. Some areas are used as cropland or pasture.

The major management concerns in the areas used as woodland are plant competition, seedling mortality, and the equipment limitation. Windthrow is a hazard on the Roscommon soils.

The major soils are poorly suited or generally unsuited to use as cropland and are moderately well suited, poorly suited, or generally unsuited to pasture. The Rubicon soils that have slopes of less than 12 percent and the Au Gres soils can be used as cropland. The main management concerns are droughtiness, soil blowing, the organic matter content, and wetness in the Roscommon soils.

The Rubicon soils are well suited to building site development. The Au Gres soils are poorly suited to this use because of wetness. The Roscommon soils are unsuited because of wetness and ponding.

4. Au Gres-Wheatley-Gladwin Association

Nearly level, somewhat poorly drained and poorly drained, sandy soils on outwash plains

This association is on broad flats, in depressions, and on low knolls in the uplands and in drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 3 percent of the county. It is about 35 percent Au Gres soils, 25 percent Wheatley soils, 20 percent Gladwin soils, and 20 percent soils of minor extent.

The Au Gres soils are nearly level and are somewhat poorly drained. Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is pale brown, mottled sand about 3 inches thick. The subsoil is about 23 inches thick. The upper part is strong brown, very friable sand. The lower part is yellowish brown, loose sand. The substratum to a depth of 60 inches is light yellowish brown and light brownish gray sand.

The Wheatley soils are nearly level and are poorly drained. Typically, the surface layer is black mucky loamy sand about 10 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and light brownish gray, mottled sand, gravelly sand, and very gravelly sand.

The Gladwin soils are nearly level and are somewhat poorly drained. Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is grayish brown sand about 6 inches thick. The subsoil is about 13 inches thick. The upper part is brown, mottled, very friable sand. The lower part is dark brown, mottled, friable gravelly sandy loam. The substratum to a depth of about 60 inches is brown and grayish brown sand and gravelly coarse sand.

The soils of minor extent are the poorly drained Brevort soils, the moderately well drained Croswell soils, and the somewhat poorly drained Iosco soils. Brevort soils are in depressions and drainageways. Croswell soils are on upland knolls. Iosco soils are on low knolls.

Most areas of this association have a cover of native vegetation, commonly trees. These soils are used mainly for wildlife habitat and urban uses. They are moderately well suited, poorly suited, or generally unsuited to use as cropland because of wetness and soil blowing. The Au Gres soils are moderately well suited or poorly suited to pasture. The main management concerns are seasonal wetness and droughtiness.

The equipment limitation, seedling mortality, and plant competition are management concerns in areas used as woodland. Also, windthrow is a hazard on the Wheatley soils.

The Au Gres and Gladwin soils are poorly suited to building site development because of wetness. The Wheatley soils are unsuited to this use because of ponding.

Nearly Level to Steep, Somewhat Excessively Drained and Well Drained Soils

Most areas of these soils are wooded. The main management concerns are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition.

A few areas are used as cropland or pasture. The major soils are well suited, moderately well suited, poorly suited, or unsuited to use as cropland and pasture. The major management concerns are the hazard of water erosion, soil blowing, and droughtiness.

5. Montcalm-Isabella Association

Nearly level to steep, well drained, sandy soils on till plains and moraines

This association is on broad plains, knolls, and ridges in the uplands. Slope ranges from 0 to 35 percent.

This association makes up about 10 percent of the county. It is about 40 percent Montcalm soils, 35 percent Isabella soils, and 25 percent soils of minor extent.

The Montcalm soils are nearly level to steep. Typically, the surface layer is dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam.

The Isabella soils are nearly level to steep. Typically, the surface layer is brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam.

The soils of minor extent are the Melita and Rubicon soils. These soils have sandy material in the subsoil. They are in landscape positions similar to those of the major soils.

This association is used as woodland. The major management concerns are the equipment limitation, seedling mortality, and plant competition. Erosion is a hazard on the steeper slopes.

The major soils are well suited or moderately well suited to building site development.

6. Graycalm-Montcalm-Klacking Association

Nearly level to steep, somewhat excessively drained and well drained, sandy soils on moraines and outwash plains

This association is on knolls and ridges in the uplands. Slope ranges from 0 to 35 percent.

This association makes up about 10 percent of the county. It is about 55 percent Graycalm soils, 27 percent Montcalm soils, 10 percent Klacking soils, and 8 percent soils of minor extent.

The Graycalm soils are nearly level to steep and are somewhat excessively drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with

bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick.

The Montcalm soils are nearly level to rolling and are well drained. Typically, the surface layer is dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam.

The Klacking soils are nearly level to steep and are well drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is strong brown, friable sandy loam and light yellowish brown, friable sand.

The most common soils of minor extent are the somewhat excessively drained Mancelona soils and the well drained Menominee soils. Both of these soils are in landscape positions similar to those of the major soils.

This association is used mainly as woodland. Some areas are used as cropland or pasture. The major management concerns in the areas used as woodland are the equipment limitation, seedling mortality, plant competition, and the hazard of erosion in hilly to steep areas.

The major soils are moderately well suited, poorly suited, or unsuited to use as cropland. The main management concerns are the hazards of water erosion and soil blowing, droughtiness, the organic matter content, and, in some areas, the slope.

The major soils are well suited, moderately well suited, or poorly suited to building site development, depending on the slope.

Nearly Level to Steep, Somewhat Excessively Drained to Somewhat Poorly Drained Soils

These soils are used as cropland, pasture, or woodland. They are the primary agricultural soils in the county. They are well suited, moderately well suited, poorly suited, or unsuited to use as cropland and pasture. The major management concerns are water erosion, soil blowing, wetness, and tilth.

The equipment limitation, the hazard of erosion, and plant competition are the main management concerns in the areas of woodland.

7. Nester-Menominee-Kawkawlin Association

Nearly level to rolling, well drained and somewhat poorly drained, sandy and loamy soils on moraines and till plains

This association is on broad plains, on ridges and knolls, in low lying areas, and in depressions in the uplands and in drainageways. Slope ranges from 0 to 18 percent.

This association makes up about 10 percent of the county. It is about 42 percent Nester soils, 13 percent Menominee soils, 12 percent Kawkawlin soils, and 33 percent soils of minor extent.

The Nester soils are undulating to rolling and are well drained. Typically, the surface layer is very dark grayish brown fine sandy loam or loam about 8 inches thick. The subsoil is about 27 inches thick. It is firm. The upper part is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam.

The Menominee soils are nearly level to rolling and are well drained. Typically, the surface layer is very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is firm, strong brown clay loam and brown sandy loam. The substratum to a depth of about 60 inches is brown clay loam.

The Kawkawlin soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is firm, brown clay loam mixed with light brownish gray fine sandy loam; the next part is brown, mottled, firm clay loam; and the lower part is brown, mottled, very firm clay. The substratum to a depth of about 60 inches is yellowish brown and brown, mottled clay loam.

The soils of minor extent are the somewhat poorly drained Iosco soils and the very poorly drained Lupton soils. Iosco soils are on low knolls and ridges. Lupton soils are in depressions and natural drainageways.

This association is used mainly as cropland or pasture. It is well suited, moderately well suited, or poorly suited to use as cropland and pasture. Water erosion is a management concern on the Nester soils and in sloping areas of the Menominee soils. Soil blowing is a management concern on both soils. Maintenance of good tilth in the Nester and Kawkawlin soils, the slope in rolling areas of the Nester soils, and

wetness in the Kawkawlin soils are also concerns. If pastures in areas of the Nester and Kawkawlin soils are overgrazed, soil compaction is a management concern.

Where the major soils are used as woodland, the main management concerns are the equipment limitation, seedling mortality, and plant competition.

The Menominee soils are well suited or moderately well suited to building site development. The slope is a limitation in some areas. The Nester soils are moderately well suited to building site development, and the Kawkawlin soils are poorly suited.

8. Selkirk-Kent Association

Nearly level to rolling, somewhat poorly drained to well drained, loamy soils on moraines and till plains

This association is on broad, low lying plains, knolls, and ridges in the uplands. Slope ranges from 0 to 18 percent.

This association makes up about 10 percent of the county. It is about 36 percent Selkirk soils, 33 percent Kent soils, and 31 percent soils of minor extent.

The Selkirk soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is dark brown, mottled, very firm clay about 6 inches thick. The substratum to a depth of about 60 inches is reddish brown and dark brown, mottled clay.

The Kent soils are nearly level to rolling and are well drained or moderately well drained. Typically, the surface layer is dark grayish brown sandy loam or loam about 9 inches thick. The subsoil is about 14 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is brown, mottled clay.

The most common soils of minor extent are the somewhat poorly drained Allendale soils and the poorly drained Pickford soils. Allendale soils are on low knolls and ridges. Pickford soils are in depressions and drainageways.

This association is used mainly as cropland or pasture. A few areas are wooded.

The major soils are moderately well suited or poorly suited to use as cropland and are well suited or moderately well suited to pasture. The major management concerns are water erosion on the Selkirk and Kent soils, soil blowing on the Kent soils, and wetness and tilth in areas of the Selkirk soils. If pastures are overgrazed, soil compaction is a management concern.

Where the soils are used as woodland, the major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition.

The Kent soils are moderately well suited to building site development, but a high shrink-swell potential and the slope in some areas are limitations. The Selkirk soils are poorly suited to building site development because of wetness and a high shrink-swell potential.

9. Nester-Kawkawlin Association

Nearly level to steep, well drained and somewhat poorly drained, loamy soils on moraines and till plains

This association is on knolls, plains, and ridgetops and in broad, low areas and depressions in the uplands. Slope ranges from 0 to 35 percent.

This association makes up about 11 percent of the county. It is about 54 percent Nester soils, 16 percent Kawkawlin soils, and 30 percent soils of minor extent.

The Nester soils are undulating to steep and are well drained. Typically, the surface layer is very dark grayish brown fine sandy loam or loam about 8 inches thick. The subsoil is about 27 inches thick. It is firm. The upper part is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam.

The Kawkawlin soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is mixed brown clay loam and light brownish gray fine sandy loam; the next part is brown, mottled, firm clay loam; and the lower part is brown, mottled, very firm clay. The substratum to a depth of about 60 inches is yellowish brown and brown, mottled clay loam.

The most common soils of minor extent are the well drained Montcalm soils on upland knolls and ridges, the somewhat poorly drained Iosco soils on low knolls, and the poorly drained Sims soils in depressions and drainageways.

This association is used mainly as cropland or pasture (fig. 3). A few areas are woodland.

The major soils are well suited, moderately well suited, or poorly suited to use as cropland and pasture. The major management concerns are water erosion and tilth in areas of the Nester soils and wetness and tilth in areas of the Kawkawlin soils. Soil blowing is an additional concern on the Nester soils. If pastures are overgrazed, water erosion and soil compaction are the major management concerns.

Where the major soils are used as woodland, the main management concerns are the equipment limitation and plant competition. The windthrow hazard is an additional management concern on the Kawkawlin soils.

The Nester soils are moderately well suited to building site development, but a moderate shrink-swell potential and the slope in the some areas are limitations. The Kawkawlin soils are poorly suited to building site development because of wetness and a moderate shrink-swell potential.

10. Mancelona-Nester-Manistee Association

Nearly level to steep, somewhat excessively drained and well drained, sandy and loamy soils on moraines

This association is on knolls, ridges, and broad plains in the uplands. Slope ranges from 0 to 35 percent.

This association makes up about 3 percent of the county. It is about 34 percent Mancelona soils, 30 percent Nester soils, 13 percent Manistee soils, and 23 percent soils of minor extent.

The Mancelona soils are nearly level to steep and are somewhat excessively drained. Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown very gravelly sand, gravelly sand, and sand.

The Nester soils are undulating to steep and are well drained. Typically, the surface layer is very dark grayish brown fine sandy loam or loam about 8 inches thick. The subsoil is about 13 inches thick. It is firm. The upper part is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam.

The Manistee soils are nearly level to rolling and are well drained. Typically, the surface layer is very dark grayish brown loamy sand about 11 inches thick. The subsurface layer is light brownish gray sand about 4 inches thick. The subsoil is about 35 inches thick. The upper part is brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay.

The most common soils of minor extent are the somewhat poorly drained Gladwin and Kawkawlin soils.

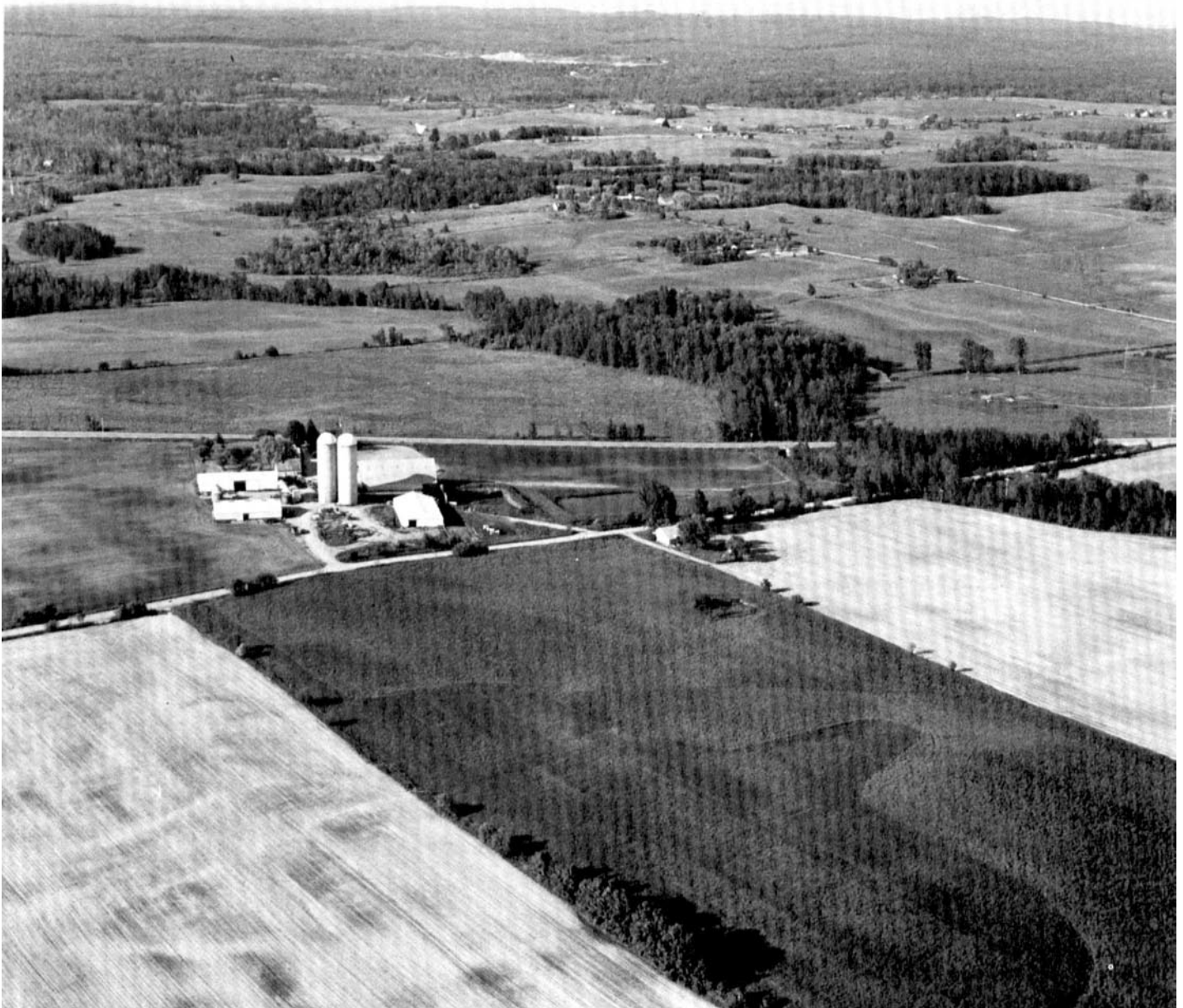


Figure 3.—An area of the Nester-Kawkawlin association used as cropland.

These soils are on low knolls and the lower part of side slopes.

This association is used mainly as woodland. Some areas are used as cropland or pasture.

Where the major soils are used as woodland, plant competition is a management concern. In addition, seedling mortality is a major management concern on

the Mancelona and Manistee soils, and the equipment limitation is a major concern on the Nester and Manistee soils.

The main limitations in the areas used as cropland or pasture are the slope, soil blowing, and water erosion. Maintaining or increasing the organic matter content is a major management concern in areas of the

Mancelona and Manistee soils. Droughtiness is a major concern in the Mancelona soils, and tilth is a major concern in the Nester soils.

The main limitation in areas of this association used for building site development is the slope.

Nearly Level and Undulating, Somewhat Poorly Drained and Poorly Drained Soils

These soils are used as woodland in most areas. The major management concerns are the equipment limitation, plant competition, and the hazard of windthrow.

A few areas are used as cropland or pasture. The major soils are well suited or moderately well suited to use as cropland and are well suited to pasture. The management concerns are wetness, tilth, and soil blowing.

11. Kawkawlin-Sims-Iosco Association

Nearly level and undulating, somewhat poorly drained and poorly drained, loamy and sandy soils on ground moraines

This association is in broad, low areas and small depressions in the uplands and in drainageways. Slope ranges from 0 to 4 percent.

This association makes up about 6 percent of the county. It is about 32 percent Kawkawlin soils, 25 percent Sims soils, 22 percent Iosco soils, and 21 percent soils of minor extent.

The Kawkawlin soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is brown, firm clay loam mixed with light brownish gray fine sandy loam; the next part is brown, mottled, firm clay loam; and the lower part is brown, mottled, very firm clay. The substratum to a depth of about 60 inches is yellowish brown and brown, mottled clay loam.

The Sims soils are nearly level and are poorly drained. Typically, the surface layer is very dark gray loam about 6 inches thick. The subsoil is grayish brown, mottled, firm silty clay loam about 11 inches thick. The substratum to a depth of about 60 inches is gray, mottled silty clay loam.

The Iosco soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is brown sand about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, mottled, loose sand. The lower part is dark brown, mottled, friable sandy loam. The substratum to a

depth of about 60 inches is light reddish brown silty clay loam.

The soils of minor extent are the well drained Nester and Menominee soils and the moderately well drained Croswell soils that have a loamy substratum. Nester and Menominee soils are in the highest positions on the landscape. The Croswell soils are in the slightly higher positions.

This association is used mainly as woodland. A few areas are used as cropland or pasture.

Where the major soils are used as woodland, the main management concerns are plant competition and the equipment limitation. Also, the windthrow hazard is a management concern on the Iosco and Sims soils, and seedling mortality is a concern on the Sims soils.

If drained, the Kawkawlin and Sims soils are well suited to cropland and pasture. Wetness and tilth are management concerns in areas of these soils. Grazing on the Kawkawlin and Sims soils during wet periods can cause surface compaction. The Iosco soils are moderately well suited to crops and are well suited to pasture. The main management concerns in areas of these soils are the hazard of soil blowing, wetness, and a low organic matter content.

The Iosco soils are poorly suited and the Kawkawlin and Sims soils unsuited to building site development because of wetness and a moderate shrink-swell potential.

Nearly Level, Very Poorly Drained and Poorly Drained Soils

These soils are used as woodland and wildlife habitat. The main management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition.

The major soils are generally unsuited to use as cropland and pasture because of wetness and instability.

12. Lupton-Roscommon Association

Nearly level, very poorly drained and poorly drained, mucky and sandy soils on outwash plains

This association is in depressional areas. Slope ranges from 0 to 2 percent.

This association makes up about 4 percent of the county. It is about 55 percent Lupton soils, 35 percent Roscommon soils, and 10 percent soils of minor extent.

The Lupton soils are nearly level and are very poorly drained. Typically, the surface layer is black muck about 4 inches thick. The underlying layers to a depth of about 60 inches are black muck.

The Roscommon soils are nearly level and are poorly drained. Typically, the surface layer is black mucky sand about 5 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown sand.

The most common soils of minor extent are the somewhat poorly drained Gladwin soils on uplands.

This association is used mainly as wildlife habitat or woodland. These soils are generally unsuited to cropland and pasture.

This association is poorly suited to woodland. The main management concerns are the windthrow hazard, the equipment limitation, seedling mortality, and plant competition.

The major soils are unsuited to building site development because of ponding, wetness, and the instability of the organic Lupton soils.

Broad Land Use Considerations

The general soil map is helpful in identifying broad areas that can be developed for residential, industrial, agricultural, and other uses. It cannot be used, however, in the selection of sites for specific structures or specific crops.

The soils in Ogemaw County vary widely in their suitability for major land uses. About 23 percent of the land in the county is cropland. Corn, small grain, and alfalfa hay are the major crops. The cropland is concentrated in associations 7 to 10. The major soils in these associations are generally suited to crops. They are on nearly level to rolling uplands and on some steeper slopes. Controlling water erosion and soil blowing, reducing wetness, and maintaining good soil tilth are the main management concerns.

The major soils in associations 2, 4, and 11 are generally suited to permanent pasture. Those in associations 4 and 11 have a seasonal high water table. Grazing when the soils are wet causes soil compaction, which can retard the growth of pasture plants. The productivity of a pasture is influenced by the number of livestock it supports, the length of the grazing time, and the distribution of rainfall. Good

pasture management includes controlled stocking rates, pasture rotations, deferred grazing, timely grazing, and strategically located livestock water.

About 66 percent of the county is woodland. Most of the woodland is in associations 1, 2, 3, 4, 5, 6, 11, and 12. Productivity is high on the upland soils in associations 2, 5, and 6; moderately high or high in associations 3 and 11; moderately high to low in association 4; and low in associations 1 and 12. Plant competition is the main management concern on the soils used as woodland in Ogemaw County. The erosion hazard, the equipment limitation, seedling mortality, and the windthrow hazard are additional concerns on many soils.

The soils in Ogemaw County range from poorly suited to well suited to use as sites for recreational uses, depending on the intensity of the expected use. The soils in associations 1 to 11 generally are suited to intensive recreational uses, such as playgrounds, camp areas, picnic areas, and paths and trails. Wetness is a limitation on the soils in association 12 and on the somewhat poorly drained soils in associations 3, 4, 7, 8, 9, and 11. The sandy texture of the excessively drained, somewhat excessively drained, and well drained soils in associations 1, 2, 3, 5, 6, and 10 is a limitation.

The suitability of the soils in the county for use as wildlife habitat is generally good throughout the county. The soils in all associations are generally suited to use as habitat for openland and woodland wildlife. The very poorly drained, organic soils in association 12 and the somewhat poorly drained and poorly drained soils in associations 3, 4, 7, 8, 9, 11, and 12 are suited to use as habitat for wetland wildlife.

The soils in associations 1, 2, and 6 are generally well suited to building site development. The slope is a limitation in places. The soils in associations 4, 8, 11, and 12 generally are poorly suited or unsuited to urban development, and those in associations 3, 5, 7, 9, and 10 are generally well suited, moderately well suited, poorly suited, or unsuited. The slope, wetness, and the shrink-swell potential are management concerns in parts of these associations.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Nester fine sandy loam, 6 to 12 percent slopes, is a phase of the Nester series.

Some map units are made up of two or more major soils. These map units are called soil complexes, or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Nester-Manistee complex, 12 to 18 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some of the boundaries on the detailed soil maps of Ogemaw County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences are the result of modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

10B—Grayling sand, 0 to 6 percent slopes. This nearly level and undulating, excessively drained soil is on broad upland plains. Individual areas are irregular in

shape and range from 3 to 3,200 acres in size.

Typically, the surface layer is very dark grayish brown sand about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, very friable sand about 25 inches thick. The substratum to a depth of about 60 inches is brownish yellow and very pale brown sand. In places the substratum has thin bands of loamy sand.

Included with this soil in mapping are small areas of the moderately well drained Croswell soils in shallow depressions. These soils make up 0 to 5 percent of the unit.

Permeability of this Grayling soil is rapid. Available water capacity is low. Runoff is very slow.

Most areas are wooded. This soil is generally unsuited to use as cropland and is poorly suited to pasture because of droughtiness.

The major management concerns in the areas of woodland are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Replanting is needed in some areas. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

The major part of this unit is managed for the preservation of habitat for Kirtland's warbler (fig. 4).

This soil is well suited to building site development.

The land capability classification is VIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.7a.

10C—Grayling sand, 6 to 18 percent slopes. This gently rolling and rolling, excessively drained soil is on knolls, side slopes, and ridges in the uplands. Individual areas are irregular in shape and range from 5 to 110 acres in size.

Typically, the surface layer is very dark grayish brown sand about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, very friable sand about 25 inches thick. The substratum to a depth of about 60 inches is brownish yellow and very pale brown sand. In places the substratum has thin bands of loamy sand.

Included with this soil in mapping are small areas of the moderately well drained Croswell soils in slight depressions. These soils make up 0 to 5 percent of the unit.

Permeability of this Grayling soil is rapid. Available water capacity is low. Runoff is slow.

Most areas are wooded. This soil is generally

unsuited to use as cropland or pasture because of droughtiness and the slope.

The main management concerns in the areas of woodland are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Replanting is needed in some areas. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is VIIIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.7a.

10E—Grayling sand, 18 to 35 percent slopes. This hilly and steep, excessively drained soil is on knolls and ridges in the uplands. Individual areas are elongated and range from 4 to 35 acres in size.

Typically, the surface layer is very dark grayish brown sand about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, very friable sand about 25 inches thick. The substratum to a depth of about 60 inches is brownish yellow and very pale brown sand. In places the substratum has thin bands of loamy sand.

Included with this soil in mapping are small areas of the moderately well drained Croswell soils in slight depressions. These soils make up 0 to 5 percent of the unit.

Permeability of this Grayling soil is rapid. Available water capacity is low. Runoff is slow.

This soil is used as woodland. It is generally unsuited to use as cropland or pasture because of droughtiness and slope.

The major management concerns in the areas of woodland are the equipment limitation, the hazard of erosion, and seedling mortality. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with traction of wheeled equipment, especially during dry periods. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to



Figure 4.—An area of Grayling sand, 0 to 6 percent slopes, managed for the preservation of the Kirtland's warbler.

prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Replanting is needed in some areas. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is poorly suited to building site development because of the slope. Some land grading may be needed.

The land capability classification is VIIs. The woodland ordination symbol is 4R. The Michigan soil management group is 5.7a.

11B—Rubicon sand, 0 to 6 percent slopes. This nearly level and undulating, excessively drained soil is on broad upland plains. Individual areas are irregular in shape and range from 5 to 300 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. In some areas the substratum has mottles and is gravelly. In other areas it is loamy.

Included with this soil in mapping are small areas of the well drained Klacking and somewhat excessively drained Graycalm and Mancelona soils. These soils are in landscape positions similar to those of the Rubicon soil. They make up 0 to 15 percent of the unit.

Permeability of this Rubicon soil is rapid. Available water capacity is low. Runoff is very slow.

This soil is used as woodland. It is generally unsuited to use as cropland and is poorly suited to pasture because of droughtiness.

The major concerns in managing woodland are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Replanting is needed in some areas. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is well suited to building site development.

The land capability classification is VIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.3a.

11C—Rubicon sand, 6 to 18 percent slopes. This gently rolling and rolling, excessively drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 900 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. In some areas the substratum has mottles and is gravelly sand.

Included with this soil in mapping are small areas of the well drained Klacking and somewhat excessively drained Graycalm and Mancelona soils. These soils are in landscape positions similar to those of the Rubicon soil. They make up 0 to 15 percent of the unit.

Permeability of this Rubicon soil is rapid. Available water capacity is low. Runoff is slow.

This soil is used as woodland. It is generally unsuited to use as cropland, hayland, or pasture because of droughtiness and the hazards of soil blowing and water erosion.

The major concerns in managing woodland are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Replanting is needed in some areas. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is VIIIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.3a.

11E—Rubicon sand, 18 to 35 percent slopes. This hilly and steep, excessively drained soil is on hills and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 70 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. In some areas the substratum is gravelly sand.

Included with this soil in mapping are small areas of the well drained Klacking and somewhat excessively drained Graycalm and Mancelona soils. These soils are in landscape positions similar to those of the Rubicon soil. They make up 0 to 15 percent of the unit.

Permeability of this Rubicon soil is rapid. Available water capacity is low. Runoff is slow.

This soil is used as woodland. It is generally unsuited to use as cropland or pasture because of droughtiness and the hazards of water erosion and soil blowing.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and

seedling mortality. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Replanting is needed in some areas. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VII_s. The woodland ordination symbol is 4R. The Michigan soil management group is 5.3a.

11F—Rubicon sand, 35 to 50 percent slopes. This very steep, excessively drained soil is on hills and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 36 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. In places the substratum has thin bands of loamy sand.

Included with this soil in mapping are small areas of the well drained Klacking and somewhat excessively drained Graycalm soils. These soils are in landscape positions similar to those of the Rubicon soil. They make up 10 to 15 percent of the unit.

Permeability of this Rubicon soil is rapid. Available water capacity is low. Runoff is medium.

This soil is used as woodland. It is generally unsuited to use as cropland or pasture because of the slope and the hazard of water erosion.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and seedling mortality. The use of equipment is restricted because of the slope. Ordinary crawler tractors and

rubber-tired skidders cannot be operated safely on these slopes. Special logging methods, such as yarding the logs with a cable, may be needed. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. Because of the slope, trees are generally not planted on this soil.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VII_s. The woodland ordination symbol is 4R. The Michigan soil management group is 5.3a.

12B—Croswell sand, 0 to 4 percent slopes. This nearly level and undulating, moderately well drained soil is on low knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 650 acres in size.

Typically, the surface layer is dark grayish brown sand about 7 inches thick. The subsurface layer is pinkish gray sand about 4 inches thick. The subsoil is loose sand about 10 inches thick. The upper part is strong brown, and the lower part is yellowish brown and mottled. The substratum to a depth of about 60 inches is very pale brown, yellowish brown, and pale brown, mottled sand. In some areas mottles are in the upper part of the subsoil. In other areas loamy bands are in the substratum. In places there are no mottles in the soil.

Included with this soil in mapping are small areas of the poorly drained Roscommon soils in the lower positions on the landscape. These soils make up 0 to 5 percent of the unit.

Permeability of this Croswell soil is rapid. Available water capacity is low. Runoff is very slow. The seasonal high water table is at a depth of 2 to 4 feet from fall through spring.

Most areas of this soil are wooded. A few areas are used as cropland or pasture.

Because of droughtiness, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay,

however, can be grown. Soil blowing and the organic matter content are management concerns. Small grain crops that are planted in fall or early in spring can make good use of the limited supply of available water. Conservation tillage, which does not invert the soil and leaves all or part of the crop residue on the surface, helps to control soil blowing. Cover crops, buffer strips, and vegetative barriers also help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Because of the seasonal high water table, trees may be shallow rooted and some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Planting containerized seedlings or special nursery stock can help to reduce the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is poorly suited to building site development because of the seasonal high water table. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system can protect basements from water.

The land capability classification is IVs. The woodland ordination symbol is 5S. The Michigan soil management group is 5a.

13A—Au Gres sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is in depressions and adjacent to drainageways in the uplands. Individual areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is pale brown,

mottled sand about 3 inches thick. The subsoil is about 23 inches thick. The upper part is strong brown, very friable sand. The lower part is yellowish brown, loose sand. The substratum to a depth of 60 inches is light yellowish brown and light brownish gray sand. In some places mottles are in the substratum. In other places the substratum is gravelly. In some areas the soil has no mottles.

Included with this soil in mapping are small areas of the poorly drained Roscommon soils in depressions. These soils make up 0 to 5 percent of the unit.

Permeability of this Au Gres soil is rapid. Available water capacity is low. Runoff is very slow. The seasonal high water table is at a depth of 6 inches to 1.5 feet from fall through spring.

Most areas of this soil are wooded. A few areas are used as cropland or pasture.

Because of wetness, this soil is poorly suited to use as cropland. Small grain and hay, however, can be grown. Soil blowing, the organic matter content, and droughtiness are management concerns. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water after heavy rainfall. Erosion-control structures may be needed where the ditches enter established drainageways. Soil blowing can be controlled by a system of conservation tillage that leaves all or part of the crop residue on the surface; cover crops, such as rye; buffer strips; vegetative barriers; and field windbreaks. Additions of organic material, such as crop residue, green manure, and manure, increase the available water capacity of the soil.

This soil is moderately well suited to pasture. The major management concern is droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted grazing during wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled and should be

drained by culverts. The number of suitable landing sites is limited because of the wetness. Measures that stabilize the landings may be needed.

Because of the wetness, seedling losses can be a concern and the trees are shallow rooted. Planting seedlings that can tolerate wetness or applying special methods of site preparation, such as bedding, can lower the seedling mortality rate. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvesting methods may be needed to control the undesirable plants. If trees are planted, mechanical or chemical measures are needed to help control plant competition.

This soil is poorly suited to building site development because of wetness. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements from water.

The land capability classification is IVw. The woodland ordination symbol is 6W. The Michigan soil management group is 5b.

14—Roscommon mucky sand. This nearly level, poorly drained soil is in depressions and drainageways in the uplands. Individual areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is black mucky sand about 5 inches thick. The substratum to a depth of 60 inches is dark grayish brown, grayish brown, and brown sand. In some places the substratum is gravelly. In other places the surface layer is muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres soils and the poorly drained Brevort soils. Au Gres soils are slightly higher on the landscape than the Roscommon soil. Brevort soils are underlain by loamy material at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Roscommon soil. Included soils make up 0 to 15 percent of the unit.

Permeability of this Roscommon soil is rapid. Available water capacity is low. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Because of wetness, this soil is generally unsuited to use as cropland and is poorly suited to pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow

hazard, and plant competition. The soil is usually wet from fall to spring and can be wet during other periods. Equipment can be used only during dry summer months and during winter months when the snow cover is adequate. Year-round logging roads should be provided with roadfill and a gravel base. Culverts are needed to maintain the natural drainage system. Landing sites are generally available only during the driest part of the year. The loss of tree seedlings is caused by wetness. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. Trees are generally not planted on this soil because of the wetness and plant competition.

This soil is generally unsuited to building site development because of the wetness and ponding.

The land capability classification is VIw. The woodland ordination symbol is 6W. The Michigan soil management group is 5c.

17B—Graycalm sand, 0 to 6 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on flats or in slightly convex areas on upland plains. Individual areas are irregular in shape and range from 3 to 15,000 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. In some areas the bands do not occur or have a combined thickness of more than 6 inches.

Included with this soil in mapping are small areas of the well drained Menominee and Montcalm soils and the somewhat excessively drained East Lake soils. Menominee soils have a loamy substratum. Montcalm soils have a subsoil that is dominantly loamy sand but has a thick layer of sandy loam. East Lake soils have gravel at a depth of 20 to 40 inches. The included soils are in landscape positions similar to those of the Graycalm soil. They make up 0 to 15 percent of the unit.

Permeability of this Graycalm soil is rapid. Available water capacity is low. Runoff is very slow.

Because of droughtiness, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Soil blowing and the organic

matter content are management concerns. Small grain crops that are planted in fall or early in spring can make good use of the limited supply of available water. Conservation tillage, which does not invert the soil and leaves all or part of the crop residue on the surface, helps to control soil blowing. Cover crops, buffer strips, and vegetative barriers also help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Most areas of this soil are wooded. Most of those in the northwestern part of the county support jack pine and are managed for the preservation of habitat for Kirtland's warbler. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting is needed in some areas.

This soil is well suited to building site development.

The land capability classification is IVs. The woodland ordination symbol is 6S. The Michigan soil management group is 5a.

17C—Graycalm sand, 6 to 18 percent slopes. This gently rolling and rolling, somewhat excessively drained soil is on knolls and ridges in the uplands. Individual areas are elongated or irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. In some areas the bands do not occur or have a combined thickness of more than 6 inches.

Included with this soil in mapping are small areas of the well drained Menominee and Montcalm soils. Menominee soils have a loamy substratum. Montcalm soils have a subsoil that is dominantly loamy sand but

has a thick layer of sandy loam. The included soils are in landscape positions similar to those of the Graycalm soil. They make up 5 to 10 percent of the unit.

Permeability of this Graycalm soil is rapid. Available water capacity is low. Runoff is slow.

Most areas are wooded. This soil is generally unsuited to use as cropland because of droughtiness and the hazards of soil blowing and water erosion.

This soil is poorly suited to pasture. The major management concerns are water erosion and droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can destroy the plant cover, increase the susceptibility to soil blowing, and result in compaction and excessive runoff. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

The major concerns in managing woodland are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting is needed in some areas.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is VIs. The woodland ordination symbol is 6S. The Michigan soil management group is 5a.

17E—Graycalm sand, 18 to 35 percent slopes. This hilly and steep, somewhat excessively drained soil is on hills and ridges in the uplands. Individual areas are elongated and range from 3 to 120 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. In some areas the bands do not occur or have a combined thickness of more than 6 inches.

Included with this soil in mapping are small areas of the well drained Menominee and Montcalm soils. Menominee soils have a loamy substratum. Montcalm soils have a subsoil that is dominantly loamy sand but has a thick layer of sandy loam. The included soils are in landscape positions similar to those of the Graycalm soil. They make up 5 to 10 percent of the unit.

Permeability of this Graycalm soil is rapid. Available water capacity is low. Runoff is slow.

Most areas are wooded. This soil is generally unsuited to use as cropland or pasture because of droughtiness, the slope, and the hazards of water erosion and soil blowing.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and seedling mortality. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is poorly suited to building site development because of the slope. Some land grading may be needed.

The land capability classification is VIIIs. The woodland ordination symbol is 6R. The Michigan soil management group is 5a.

18B—Klacking sand, 0 to 6 percent slopes. This nearly level and undulating, well drained soil is on flats or in slightly convex areas on upland plains. Individual areas are irregular in shape and range from 3 to 600 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is strong brown, friable sandy loam and light yellowish brown sand. In some areas the bands have a combined thickness of less than 6 inches. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of the excessively drained Rubicon soils and the somewhat excessively drained East Lake and Melita soils. Rubicon soils are sandy throughout. East Lake soils have a gravelly substratum. Melita soils have a

loamy substratum. The included soils are in landscape positions similar to those of the Klacking soil. They make up 0 to 15 percent of the unit.

Permeability is rapid in the upper part of this Klacking soil and moderately rapid in the lower part. Available water capacity is low. Runoff is very slow.

Most areas of this soil are wooded (fig. 5). A few areas are used as cropland or pasture.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are droughtiness, soil blowing, and the organic matter content. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, increase the available water capacity of the soil. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing.

This soil is well suited to pasture. The major management concern is droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting generally is needed in some areas.

This soil is well suited to building site development.

The land capability classification is IIIs. The woodland ordination symbol is 6S. The Michigan soil management group is 4a.

18C—Klacking sand, 6 to 18 percent slopes. This gently rolling and rolling, well drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is strong brown, friable sandy loam and light yellowish brown sand. In some areas the bands have a combined thickness of less than 6 inches. In other



Figure 5.—A red pine plantation in an area of Klacking sand, 0 to 6 percent slopes.

areas the subsoil has more clay.

Included with this soil in mapping are small areas of the excessively drained Rubicon soils and the somewhat excessively drained Melita soils. Rubicon soils are sandy throughout. Melita soils have a loamy substratum. The included soils are in landscape positions similar to those of the Klacking soil. They

make up 0 to 15 percent of the unit.

Permeability is rapid in the upper part of this Klacking soil and moderately rapid in the lower part. Available water capacity is low. Runoff is slow.

Most areas of this soil are wooded. A few areas are used as cropland or pasture.

This soil is poorly suited to use as cropland. Corn,

small grain, and alfalfa hay, however, can be grown. The major management concerns are water erosion, soil blowing, the organic matter content, droughtiness, and slope. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion by increasing the rate of water infiltration. Close-growing crops, grassed waterways, cover crops, and the incorporation of crop residue into the soil help to prevent excessive soil loss. Grassed waterways, diversions, and erosion-control structures can be used to prevent gully erosion. Conservation tillage, cover crops, buffer strips, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure crops, and manure, increase the available water capacity of the soil.

This soil is moderately well suited to pasture. The major management concerns are water erosion and droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting is needed in some areas.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is IVe. The woodland ordination symbol is 6S. The Michigan soil management group is 4a.

18E—Klacking sand, 18 to 35 percent slopes. This hilly and steep, well drained soil is on hills and ridges in the uplands. Individual areas are elongated or irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is strong brown, friable sandy loam and light yellowish brown sand. In some areas the bands have a combined thickness of less than 6 inches. In other

areas the subsoil has more clay.

Included with this soil in mapping are small areas of the excessively drained Rubicon soils. These soils are sandy throughout. They are in landscape positions similar to those of the Klacking soil. They make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of this Klacking soil and moderately rapid in the lower part. Available water capacity is low. Runoff is slow.

Most areas are wooded. This soil is generally unsuited to use as cropland or pasture because of the slope, droughtiness, and the hazards of water erosion and soil blowing.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and seedling mortality. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is poorly suited to building site development because of the slope. Land grading may be needed.

The land capability classification is VIIe. The woodland ordination symbol is 6R. The Michigan soil management group is 4a.

20B—Montcalm loamy sand, 0 to 6 percent slopes. This nearly level and undulating, well drained soil is on flats or in slightly convex areas on upland plains. Individual areas are irregular in shape and range from 3 to 350 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy

sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Included with this soil in mapping are small areas of the well drained Menominee soils and the excessively drained Rubicon soils. Menominee soils have a loamy substratum. Rubicon soils do not have bands in the subsoil. The included soils are in landscape positions similar to those of the Montcalm soil. They make up 0 to 10 percent of the unit.

Permeability of this Montcalm soil is moderately rapid. Available water capacity is moderate. Runoff is slow.

Most areas of this soil are wooded. A few areas are used for cropland or pasture.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are soil blowing and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Applying a system of conservation tillage, including green manure crops in the cropping system, and returning crop residue to the soil help to maintain or increase the organic matter content.

This soil is well suited to pasture. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

The major concern in managing woodland is plant competition. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is well suited to building site development.

The land capability classification is IIIs. The woodland ordination symbol is 3A. The Michigan soil management group is 4a.

20C—Montcalm loamy sand, 6 to 18 percent slopes. This gently rolling and rolling, well drained soil is on knolls and ridges. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown,

friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Included with this soil in mapping are small areas of the well drained Menominee soils and the excessively drained Rubicon soils. Menominee soils have a loamy substratum. Rubicon soils do not have bands in the subsoil. The included soils are in landscape positions similar to those of the Montcalm soil. They make up 0 to 10 percent of the unit.

Permeability of this Montcalm soil is moderately rapid. Available water capacity is moderate. Runoff is slow.

Most areas of this soil are wooded. A few areas are used as cropland.

Because of the hazards of water erosion and soil blowing, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, conserve soil moisture.

This soil is moderately well suited to pasture. Overgrazing during very dry periods increases the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

The major concern in managing woodland is plant competition. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is IVe. The woodland ordination symbol is 3A. The Michigan soil management group is 4a.

20E—Montcalm loamy sand, 18 to 35 percent slopes. This hilly and steep, well drained soil is on hills and ridges. Individual areas are irregular in shape and range from 5 to 70 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Included with this soil in mapping are small areas of the well drained Menominee soils and the excessively drained Rubicon soils. Menominee soils have a loamy substratum. Rubicon soils do not have bands in the subsoil. The included soils are in landscape positions similar to those of the Montcalm soil. They make up 0 to 10 percent of the unit.

Permeability of this Montcalm soil is moderately rapid. Available water capacity is moderate. Runoff is medium.

This soil is used as woodland. It is generally unsuited to use as cropland or pasture because of the slope and the hazards of water erosion and soil blowing.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and plant competition. The use of equipment is restricted because of the slope. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is poorly suited to building site development because of the slope. Land grading may be needed.

The land capability classification is VIIe. The woodland ordination symbol is 3R. The Michigan soil management group is 4a.

21—Histosols and Aquepts, ponded. These nearly level, very poorly drained soils are in depressions and along streams and the edges of lakes. The soils have a high water table at or above the surface throughout the year. The Histosols are organic, and the Aquepts are sandy or loamy. Some areas are made up entirely of either Histosols or Aquepts, and others are made up of both soils. Individual areas are irregularly shaped or oval and range from 5 to 250 acres in size.

Included with these soils in mapping are small areas of open water. These areas make up less than 20 percent of the unit.

Most of the acreage is marsh. The vegetation is mainly cattails, reeds, and grasses. Clumps of trees and shrubs are along the edges of the mapped areas. These soils provide habitat for waterfowl, beavers, muskrats, and other animals that prefer a wetland environment. The soils are generally unsuited to most other uses.

The land capability classification is VIIIw. No other interpretive groups are assigned.

22B—Nester fine sandy loam, 2 to 6 percent slopes. This undulating, well drained soil is on knolls and broad plains in the uplands. Individual areas are irregular in shape and range from 3 to 1,500 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the surface layer is loam or clay loam. In places the upper part of the subsoil is sandy loam.

Included with this soil in mapping are some small areas of the somewhat poorly drained Kawkawlin soils and the well drained Manistee soils. Kawkawlin soils are lower on the landscape than the Nester soil. Manistee soils have a sandy surface layer. They are in landscape positions similar to those of the Nester soil. Included soils make up 0 to 10 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, tilth, and the organic matter

content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rain. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Such cover crops as rye, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, improve tilth (fig. 6).

This soil is well suited to pasture. The major management concern is surface compaction. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted in the spring and other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is moderately well suited to building site development. The moderate shrink-swell potential is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIe. The woodland ordination symbol is 3L. The Michigan soil management group is 1.5a.

22B2—Nester loam, 2 to 6 percent slopes, eroded.

This undulating, well drained soil is on knolls and broad upland plains. Much of the original surface soil has been eroded away. The remaining surface soil has been mixed with the upper part of the subsoil by tillage. Individual areas are irregular in shape and range from 12 to 110 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 1 inch of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil

has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion. In some areas the surface layer is sandy loam or clay loam.

Included with this soil in mapping are some small areas of the somewhat poorly drained Kawkawlin soils and the well drained Manistee soils. Kawkawlin soils are lower on the landscape than the Nester soil. Manistee soils have a sandy surface layer. They are in landscape positions similar to those of the Nester soil. Included soils make up 0 to 10 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

This soil is used as cropland. It is well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, tilth, and the organic matter content. Erosion has damaged this soil and reduced its organic matter content and natural fertility. Crusting can result in the uneven germination of seeds and can reduce yields. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is moderately well suited to building site development. The moderate shrink-swell potential is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIe. The woodland ordination symbol is 3L. The Michigan soil management group is 1.5a.

22C—Nester fine sandy loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls, ridges, and broad upland plains. Individual areas are irregular in shape and range from 3 to 400 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam.



Figure 6.—Corn stubble in an area of Nester fine sandy loam, 2 to 6 percent slopes.

In some places the subsoil has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by plowing.

Included with this soil in mapping are some small areas of the somewhat poorly drained Kawkawlin soils. These soils are lower on the landscape than the Nester soil. They make up less than 5 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, tilth, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rainfall. A cropping system that includes close-growing

crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Such cover crops as rye, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, help to improve tilth.

This soil is well suited to pasture. The major management concerns are surface compaction and water erosion. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted in the spring and other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is moderately well suited to building site development. The slope and the moderate shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 3L. The Michigan soil management group is 1.5a.

22C2—Nester loam, 6 to 12 percent slopes, eroded. This gently rolling, well drained soil is on knolls, ridges, and broad upland plains. Much of the original surface soil has been eroded away. The remaining surface soil has been mixed with the upper part of the subsoil by tillage. Individual areas are irregular in shape and range from 3 to 400 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 1 inch of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by

plowing and erosion. In some areas the surface layer is sandy loam or clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Kawkawlin soils. These soils are lower on the landscape than the Nester soil. They make up less than 5 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

This soil is used as cropland. It is poorly suited to crops because of past erosion and the hazard of further water erosion. Corn, small grain, and alfalfa hay, however, can be grown. The major management concerns are water erosion, tilth, and the organic matter content. Erosion has damaged this soil and reduced its organic matter content and natural fertility. Crusting can result in the uneven germination of seeds and can reduce yields. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Minimizing tillage and tilling the soil at the proper moisture content help to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is moderately well suited to building site development. The slope and the moderate shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 3L. The Michigan soil management group is 1.5a.

22D—Nester fine sandy loam, 12 to 18 percent slopes. This rolling, well drained soil is on knolls and ridges. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 13 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by plowing.

Included with this soil in mapping are small areas of the well drained Manistee soils. These soils have a sandy surface layer. They are in landscape positions similar to those of the Nester soil. They make up 0 to 10 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is rapid. The shrink-swell potential is moderate.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

Because of the hazard of water erosion, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Soil blowing, tilth, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures can help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is moderately well suited to pasture. The major management concerns are surface compaction and water erosion. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted in spring and other excessively wet periods. If the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is moderately well suited to building site development. The slope and the moderate shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IVe. The

woodland ordination symbol is 3L. The Michigan soil management group is 1.5a.

22D2—Nester loam, 12 to 18 percent slopes, eroded. This rolling, well drained soil is on knolls and ridges. Much of the original surface soil has been eroded away. The remaining surface soil has been mixed with the upper part of the subsoil by tillage. In areas not protected by a plant cover, rills and small gullies form after rains of moderate intensity. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 1 inch of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by plowing and erosion. In some areas the surface layer is fine sandy loam or clay loam.

Included with this soil in mapping are small areas of the well drained Manistee soils. These soils have a sandy surface layer. They are in landscape positions similar to those of the Nester soil. They make up 0 to 10 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is rapid. The shrink-swell potential is moderate.

This soil is used as cropland. It is poorly suited to crops because of past water erosion and the hazard of further erosion. Corn, small grain, and alfalfa hay, however, can be grown. Tilth and the organic matter content are management concerns. Erosion has damaged this soil and reduced its organic matter content and natural fertility. Crusting can result in the uneven germination of seeds and can reduce yields. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Minimizing tillage and tilling the soil at the proper moisture content help to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is moderately well suited to building site development. The slope and the moderate shrink-swell

potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IVe. The woodland ordination symbol is 3L. The Michigan soil management group is 1.5a.

22D3—Nester clay loam, 12 to 25 percent slopes, severely eroded. This rolling and hilly, well drained soil is on knolls and ridges in the uplands. Much of the original surface soil has been eroded away. The remaining surface soil has been mixed with the upper part of the subsoil by tillage. In areas not protected by a plant cover, rills and small gullies form after rains of moderate intensity (fig. 7). Individual areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is brown clay loam about 8 inches thick. The subsoil is dark yellowish brown and yellowish brown clay loam about 21 inches thick. It is firm. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil has more clay. In other places the surface layer is sandy loam or loam. In some areas the substratum is exposed.

Included with this soil in mapping are small areas of the well drained Manistee soils. These soils have a sandy surface layer. They are in landscape positions similar to those of the Nester soil. They make up 0 to 10 percent of the unit.

Permeability of this Nester soil is slow. Available water capacity is high. Runoff is very rapid. The shrink-swell potential is moderate.

This soil generally is used as cropland. A few areas have been converted to pasture.

Because of past water erosion and the hazard of further erosion, this soil is generally unsuited to use as cropland. Small areas of this soil are generally in larger fields of the less eroded Nester soils.

This soil is poorly suited to pasture. The major management concerns are surface compaction and water erosion. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

This soil is moderately well suited to building site development. The slope and the moderate shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is VIe. No woodland

ordination symbol is assigned. The Michigan soil management group is 1.5a.

22E—Nester fine sandy loam, 18 to 35 percent slopes. This hilly and steep, well drained soil is on hills and ridges in the uplands. Individual areas are elongated and range from 3 to 80 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In some places the mixed upper part of the subsoil does not occur. In other places the surface layer and subsoil are sandy loam.

Permeability is slow. Available water capacity is high. Runoff is rapid or very rapid. The shrink-swell potential is moderate.

Most areas of this soil are wooded. Some areas are used as pasture or are idle. Because of the slope and the hazard of water erosion, this soil is generally unsuited to use as cropland or pasture.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the hazard of erosion, and plant competition. The use of equipment is limited because of the slope. Special care is needed in laying out roads and landings and in operating equipment. The number of suitable landing sites is minimal. The use of equipment is briefly restricted in spring and other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Because of the hazard of erosion, skid roads and logging roads should be established on the contour. Water should be removed with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging areas, and skid roads after the trees are logged helps to establish a protective cover. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R. The Michigan soil management group is 1.5a.



Figure 7.—An area of Nester clay loam, 12 to 25 percent slopes, severely eroded.

22F—Nester fine sandy loam, 35 to 50 percent slopes. This very steep, well drained soil is on ridges in the uplands. Individual areas are elongated and range from 3 to 40 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the mixed upper part of the subsoil does not occur.

Permeability is slow. Available water capacity is high. Runoff is very rapid. The shrink-swell potential is moderate.

This soil is used as woodland. It is generally unsuited to use as cropland or pasture because of the slope and the hazard of water erosion.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and plant competition. The hazard of erosion is severe. Special precautions are needed to control erosion. Steep yarding paths or skid trails are subject to rilling and gullying unless the surface is protected by diversions, water bars, and a plant cover. Cable yarding systems are generally safer and disturb the surface less extensively than other systems. Because of the hazard of erosion, skid roads and skid trails should be established on the contour. Water should be removed with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging

areas, and skid roads after the trees are logged helps to establish a protective plant cover. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R. The Michigan soil management group is 1.5a.

23B—Kawkawlin loam, 0 to 4 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on low knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 500 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is firm, brown clay loam mixed with light brownish gray fine sandy loam; the next part is brown, mottled, firm clay loam; and the lower part is brown, mottled, very firm clay. The substratum to a depth of 60 inches is yellowish brown and brown, mottled clay loam. In some areas less clay is in the subsoil and substratum. In other areas the surface layer is sandy loam.

Included with this soil in mapping are small areas of the well drained Nester soils and the poorly drained Sims soils. Nester soils are on knolls and ridges. Sims soils are in depressions and drainageways. Included soils make up 0 to 15 percent of the unit.

Permeability of this Kawkawlin soil is slow. Available water capacity is high. Runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from fall to late spring. The shrink-swell potential is moderate in the substratum.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

This soil is well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, wetness, and tilth. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water after heavy rains. Erosion-control structures may be needed where the ditches enter established drainageways. Minimizing tillage and tilling the soil at the proper moisture content help to prevent clodding and compaction. Returning crop residue to the soil or regularly adding other organic

material helps to prevent crusting, increases the rate of water infiltration, and improves tilth.

This soil is well suited to pasture. The major management concerns are wetness and surface compaction. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in the spring and in other excessively wet periods. The upper part of the subsoil is saturated during these periods. The degree of saturation generally is higher on the lower parts of the slopes. Ruts form easily if skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, alter soil structure, and expose tree roots. Year-round roads should be provided with roadfill and gravel. Culverts are needed to maintain the natural drainage system. Because of wetness, trees are shallow rooted. Some may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After the overstory is removed, plant competition from unwanted species may be severe. Special harvest methods may be needed to control undesirable plants.

This soil is poorly suited to building site development because of the wetness and the moderate shrink-swell potential. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system can protect basements from water. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIe. The woodland ordination symbol is 3W. The Michigan soil management group is 1.5b.

24—Sims loam. This nearly level, poorly drained soil is in depressional areas and drainageways. Individual areas are elongated or irregular in shape and range from 3 to 350 acres in size.

Typically, the surface layer is black loam about 6 inches thick. The subsoil is grayish brown, mottled, firm silty clay loam about 11 inches thick. The substratum to a depth of about 60 inches is gray, mottled silty clay loam. In places the subsoil has more clay. In some areas the surface layer is sandy. In other areas it is muck.

Included with this soil in mapping are small areas of

the somewhat poorly drained Kawkawlin soils. These soils are slightly higher on the landscape than the Sims soil. They make up 0 to 10 percent of the unit.

Permeability of this Sims soil is slow. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring. The shrink-swell potential is moderate.

Most areas are used as cropland or woodland. Where drained, this soil is well suited to corn, small grain, and alfalfa hay. The major management concerns are wetness and tilth. An artificial drainage system is needed for optimum yields. A subsurface drainage system functions satisfactorily where suitable outlets are available. Shallow surface ditches are effective in removing surface water after heavy rains. Lift pumps may be needed in some areas to provide adequate drainage outlets. Minimizing tillage and tilling the soil at the proper moisture content help to prevent clodding and compaction. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, and the incorporation of crop residue into the soil improve tilth.

Where this soil is used as woodland, the equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The soil is usually wet from fall to spring and can be wet during other periods. Equipment can be used only during dry summer months and during winter months when the snow cover is adequate. Ruts form easily if wheeled skidders are used when the soil is wet. Year-round logging roads should be provided with roadfill and a gravel base. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is severely limited by the wetness. Because of the wetness, seedling losses can be a concern and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration. Special harvesting methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

This soil is unsuited to building site development because of the wetness and ponding.

The land capability classification is 1lw. The woodland ordination symbol is 2W. The Michigan soil management group is 1.5c.

25B—Kent sandy loam, 2 to 6 percent slopes. This undulating, moderately well drained soil is on low knolls,

ridges, and broad upland plains. Individual areas are irregular in shape and range from 3 to 1,500 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 14 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is brown, mottled clay. In some areas less clay is in the subsoil. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion.

Included with this soil in mapping are small areas of the somewhat poorly drained Selkirk soils and the well drained Manistee soils. Selkirk soils are lower on the landscape than the Kent soil. Manistee soils have a sandy surface layer. They are in landscape positions similar to those of the Kent soil. Included soils make up 0 to 10 percent of the unit.

Permeability of this Kent soil is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high. The seasonal high water table is at a depth of 2 to 3 feet from fall through spring.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, tilth, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gully. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is well suited to pasture. The major management concern is compaction. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The slow permeability and the sticky and plastic qualities of the subsoil limit the use of equipment in spring and in other excessively wet periods. Operating equipment during wet periods can result in soil compaction and damage to tree roots. If

the soil is wet, unsurfaced roads and landings are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

This soil is poorly suited to building site development because of the high shrink-swell potential. Waterproofing walls and installing an artificial drainage system help to protect basements from water. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 8C. The Michigan soil management group is 1a.

25B2—Kent loam, 2 to 6 percent slopes, eroded.

This undulating, moderately well drained soil is on knolls, ridges, and broad upland plains. Much of the original surface soil has been eroded away. The remaining surface soil has been mixed with the upper part of the subsoil by tillage. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 9 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is brown, mottled clay. In some areas the subsoil has less clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing and erosion. In places the surface layer is sandy loam or clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Selkirk soils and the well drained Manistee soils. Selkirk soils are on foot slopes and in depressions. Manistee soils have a sandy surface layer. They are in landscape positions similar to those of the Kent soil. Included soils make up 0 to 10 percent of the unit.

Permeability of this Kent soil is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high. The seasonal high water table is at a depth of 2 to 3 feet from fall through spring.

This soil is used as cropland. It is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, tilth, and the organic matter content. Erosion has damaged this soil and reduced its organic matter content and natural fertility. Crusting can result in the uneven germination of

seeds and can reduce yields. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is poorly suited to building site development because of the high shrink-swell potential. Waterproofing walls and installing an artificial drainage system help to protect basements from water. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 8C. The Michigan soil management group is 1a.

25C—Kent sandy loam, 6 to 12 percent slopes.

This gently rolling, well drained soil is on knolls, ridges, and broad upland plains. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 14 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In some areas the subsoil has less clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing and erosion.

Included with this soil in mapping are some small areas of the somewhat poorly drained Selkirk soils and the well drained Manistee soils. Selkirk soils are lower on the landscape than the Kent soil. Manistee soils have a sandy surface layer. They are in landscape positions similar to those of the Kent soil. Included soils make up 0 to 10 percent of the unit.

Permeability of this Kent soil is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high.

Most areas of this soil are used as cropland. A few areas are used as pasture.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, tilth, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface

helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. Minimizing tillage and tilling the soil at the proper moisture content help to prevent clodding and compaction. Additions of organic material, including crop residue, green manure, and manure, improve tilth.

This soil is well suited to pasture. The major management concerns are compaction and water erosion. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The slow permeability and the sticky and plastic qualities of the subsoil limit the use of equipment in spring and in other excessively wet periods. Operating equipment during wet periods can result in soil compaction and damage to tree roots. If the soil is wet, unsurfaced roads and landings are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

This soil is poorly suited to building site development because of the slope and the high shrink-swell potential. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 8C. The Michigan soil management group is 1a.

25C2—Kent loam, 6 to 12 percent slopes, eroded.

This gently rolling, well drained soil is on knolls, ridges, and broad upland plains. Much of the original surface soil has been eroded away. The remaining surface soil has been mixed with the upper part of the subsoil by tillage. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 9 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark

brown, very firm clay. The substratum to a depth of about 60 inches is brown clay. In some areas the subsoil has less clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing and erosion. In places the surface layer is sandy loam or clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Selkirk soils and the well drained Manistee soils. Selkirk soils are on foot slopes and in depressions. Manistee soils have a sandy surface layer. They are in landscape positions similar to those of the Kent soil. Included soils make up 0 to 10 percent of the unit.

Permeability of this Kent soil is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high.

This soil generally is used as cropland. A few areas have been converted to pasture.

Because of the hazard of water erosion, this soil is poorly suited to crops. Corn, small grain, and alfalfa hay, however, can be grown. Tilth and the organic matter content are management concerns. Erosion has damaged this soil and reduced its organic matter content and natural fertility. Crusting can result in the uneven germination of seeds and can reduce yields. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is well suited to pasture. The major management concerns are compaction and water erosion. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is poorly suited to building site development because of the slope and the high shrink-swell potential. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 8C. The Michigan soil management group is 1a.

25D—Kent sandy loam, 12 to 18 percent slopes.

This rolling, well drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 14 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is brown clay. In some areas the subsoil has less clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion.

Included with this soil in mapping are small areas of Manistee soils. These soils have a sandy surface layer. They are in landscape positions similar to those of the Kent soil. They make up 0 to 10 percent of the unit.

Permeability of this Kent soil is slow. Available water capacity is moderate. Runoff is rapid. The shrink-swell potential is high.

Most areas of this soil are used as woodland or pasture. A few areas are used as cropland.

Because of the hazard of water erosion, this soil is poorly suited to crops. Some crops, such as corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, tilth, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Additions of organic material, such as crop residue, green manure, and manure, improve tilth.

This soil is moderately well suited to pasture. The major management concerns are surface compaction and water erosion. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The slow permeability and the sticky and plastic qualities of the subsoil limit the use of equipment in spring and in other excessively wet periods. Operating equipment during wet periods can

result in compaction and damage to tree roots. If the soil is wet, unsurfaced roads and landings are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

This soil is poorly suited to building site development because of the slope and the high shrink-swell potential. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IVe. The woodland ordination symbol is 8C. The Michigan soil management group is 1a.

26B—Selkirk loam, 0 to 4 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on low knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 2,000 acres in size.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is dark brown, mottled, very firm clay about 6 inches thick. The substratum to a depth of about 60 inches is reddish brown and dark brown, mottled clay. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the well drained Kent soils on knolls and ridgetops and the poorly drained Pickford soils in depressions and drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability of this Selkirk soil is slow. Available water capacity is moderate. Runoff is slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from fall to spring. The shrink-swell potential is high.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, wetness, and tilth. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. Both surface and subsurface drainage systems are needed to reduce the wetness. Erosion-control structures may be needed where the ditches enter established drainageways. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. Returning crop residue to the soil or

regularly adding other organic material helps to prevent crusting, increases the rate of water infiltration, and improves tilth.

This soil is well suited to pasture. The major management concerns are wetness and surface compaction. Overgrazing or grazing when the soil is too wet causes surface compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The wetness and the sticky and plastic qualities of the subsoil limit the use of equipment in fall and spring and in other excessively wet periods. Operating equipment during wet periods can result in compaction and damage to tree roots. Equipment should be used only when the soil is dry or has an adequate snow cover. If the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled and should be drained by culverts. Landings should be stabilized so that they can withstand the repeated use of heavy equipment. The small included areas of Kent soils in the slightly higher landscape positions can be used as sites for landings.

Seedling losses can be a management concern. Special site preparation, such as bedding, and drainage measures can reduce the seedling mortality rate. Because of the seasonal high water table and the firm subsoil, trees on this soil are shallow rooted. Some may be blown down during periods of high wind and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay regeneration unless precautionary measures are applied. Special harvest methods and site preparation may be needed to control the undesirable plants.

This soil is poorly suited to building site development because of the wetness and the high shrink-swell potential. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements from water. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 2C. The Michigan soil management group is 1b.

27—Pickford silty clay loam. This nearly level, poorly drained soil is in depressional areas and drainageways. It is subject to ponding. Individual areas are elongated or irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 9 inches thick. The subsoil is gray, mottled, firm clay about 21 inches thick. The substratum to a depth of about 60 inches is gray, mottled clay. In places the subsoil has less clay. In some areas the surface layer is sand. In other areas it is muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Selkirk soils. These soils are slightly higher on the landscape than the Pickford soil. They make up 0 to 5 percent of the unit.

Permeability of this Pickford soil is very slow. Available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring. The shrink-swell potential is moderate.

In most areas this soil is used as cropland or woodland. Where drained, it is moderately well suited to corn, small grain, and trefoil hay. The major management concerns are wetness and tilth. A drainage system is needed. Subsurface drains function satisfactorily where suitable outlets are available. Shallow surface ditches are effective in removing surface water after heavy rains. Lift pumps may be needed in some areas to provide adequate drainage outlets. Minimizing tillage or tilling the soil at the proper moisture content helps to prevent clodding and compaction. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, and the incorporation of crop residue into the soil improve tilth.

Where drained, this soil is well suited to pasture. The major management concerns are wetness and surface compaction. Overgrazing or grazing when the soil is wet causes surface compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. The soil is usually wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used when the soil is wet. Equipment should be used only during dry summer months and during winter months

when the snow cover is adequate. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

Undesirable plants that invade clearcut areas may prevent the establishment of desired tree species. The loss of tree seedlings is caused by wetness. Special harvest methods may be needed to control the undesirable plants. Because of the wetness, severe seedling mortality, and plant competition, trees are not planted on this soil.

This soil is generally unsuited to building site development because of the wetness and ponding.

The land capability classification is IIIw. The woodland ordination symbol is 6W. The Michigan soil management group is 1c.

28—Udorthents, loamy, nearly level. This map unit consists mainly of nearly level, well drained to somewhat poorly drained soils that have been disturbed. Some areas are undulating. In some places removal of the original surface soil and some of the substratum has exposed loamy material. In other places the original soil has been covered with loamy fill material. Individual areas vary considerably in shape. They commonly are bordered by escarpments. They range from 3 to 70 acres in size.

Included with these soils in mapping are small areas of poorly drained soils. These included soils make up 0 to 10 percent of the unit.

Most areas of this map unit are idle or are used as building sites. Onsite investigation is needed to determine the hazards and limitations affecting specific uses.

This unit is not assigned to interpretive groups.

29—Udipsamments, nearly level. This map unit consists of nearly level, excessively drained to somewhat poorly drained soils that have been disturbed. In some areas removal of the original surface soil and some of the substratum has exposed sandy material. In other areas the original soil has been covered with sandy fill material. Individual areas vary considerably in shape. They commonly are bordered by escarpments. They range from 3 to 60 acres in size.

Included with these soils in mapping are small areas of poorly drained soils. These included soils make up 0 to 10 percent of the unit.

Most areas of this map unit are idle or are used as building sites. Onsite investigation is necessary to

determine the hazards and limitations affecting specific uses.

This unit is not assigned to interpretive groups.

30B—Isabella loamy sand, 2 to 6 percent slopes.

This undulating, well drained soil is on knolls, ridges, and broad upland plains. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In cultivated areas the upper 8 inches has been mixed into a sandy loam surface layer. In some places the subsoil has more clay. In other places it has less clay.

Included with this soil in mapping are small areas of Melita and Belding soils. The somewhat excessively drained Melita soils are in landscape positions similar to those of the Isabella soil. They have a sandy surface layer and subsoil. Belding soils are somewhat poorly drained and are lower on the landscape than the Isabella soil. Included soils make up 0 to 5 percent of the unit.

Permeability of this Isabella soil is moderate.

Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

This soil is well suited to corn, small grain, and alfalfa hay. It also is well suited to pasture. The major management concerns in the areas of cropland are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly

restricted in spring and other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is moderately well suited to building site development. The moderate shrink-swell potential is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIe. The woodland ordination symbol is 3L. The Michigan soil management group is 2.5a.

30C—Isabella loamy sand, 6 to 12 percent slopes.

This gently rolling, well drained soil is on knolls, ridges, and broad upland plains. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In cultivated areas the upper 8 inches has been mixed into a sandy loam surface layer. In some places it has more clay. In other places it has less clay.

Included with this soil in mapping are small areas of Melita and Belding soils. The somewhat excessively drained Melita soils are in landscape positions similar to those of the Isabella soil. They have a sandy surface layer and subsoil. Belding soils are somewhat poorly drained and are lower on the landscape than the Isabella soil. Included soils make up 0 to 15 percent of the unit.

Permeability of this Isabella soil is moderate. Available water capacity is high. Runoff is slow to medium. The shrink-swell potential is moderate.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops

helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Applying a system of conservation tillage, including green manure crops in the cropping system, and returning crop residue to the soil help to maintain or increase the organic matter content.

This soil is well suited to pasture. The major management concern is water erosion. Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted in spring and other excessively wet periods. If the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is moderately well suited to building site development. The slope and the moderate shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 3L. The Michigan soil management group is 2.5a.

30D—Isabella loamy sand, 12 to 18 percent slopes.

This rolling, well drained soil is on knolls and ridges in the uplands. Individual areas are elongated or irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is dark brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray, very friable loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Included with this soil in mapping are small areas of the somewhat excessively drained Melita soils. These soils have a sandy surface layer and subsoil. They are in landscape positions similar to those of the Isabella soil. They make up 0 to 5 percent of the unit.

Permeability of this Isabella soil is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the substratum.

Most areas of this soil are wooded. A few areas are used as cropland.

Because of the hazard of water erosion, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is water erosion. Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted in spring and other excessively wet periods. If the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is only moderately well suited to building site development because of the slope and the moderate shrink-swell potential. Some land grading may be needed. Proper designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IVe. The woodland ordination symbol is 3L. The Michigan soil management group is 2.5a.

30E—Isabella loamy sand, 18 to 35 percent slopes. This hilly and steep, well drained soil is on ridges in the uplands. Individual areas are elongated and range from 10 to 100 acres in size.

Typically, the surface layer is dark brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about

30 inches thick. In sequence downward, it is yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the substratum.

Most areas are wooded. Because of the slope and the hazard of water erosion, this soil is unsuited to use as cropland or pasture.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and plant competition. The use of equipment is restricted by the slope. Special care is needed in laying out roads and landings and in operating equipment. The use of equipment is briefly restricted in spring and other excessively wet periods. If the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Because of the hazard of erosion, skid roads and skid trails should be established on the contour. Water should be removed with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging areas, and skid roads after the trees are logged helps to establish a protective plant cover. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R. The Michigan soil management group is 2.5a.

32—Angelica loam. This nearly level, poorly drained soil is in depressional areas and drainageways. Individual areas are elongated or irregular in shape and range from 3 to 350 acres in size.

Typically, the surface layer is very dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown and dark brown, mottled, firm clay loam about 8 inches thick. The substratum to a depth of 60 inches is brown and light brown, mottled loam. In some places the surface layer is muck. In other places the subsoil and substratum have more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Kawkawlin soils. These soils are slightly higher on the landscape than the Angelica soil. They make up 5 to 10 percent of the unit.

Permeability of this Angelica soil is moderately slow. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Most areas of this soil are wooded or are idle. A few areas are used as cropland.

Where drained, this soil is well suited to corn, small grain, and alfalfa hay. The major management concerns are wetness and tilth. A drainage system is needed. Subsurface drains function satisfactorily where suitable outlets are available. Shallow surface ditches are effective in removing surface water after heavy rains. Lift pumps may be needed in some areas to provide adequate drainage outlets. Minimizing tillage and tilling the soil at the proper moisture content help to prevent clodding and compaction. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, and the incorporation of crop residue into the soil improve tilth.

Where drained, this soil is well suited to pasture. The major management concerns are wetness and surface compaction. Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The soil is wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used when the soil is wet. Equipment should be used only during dry summer months and during winter months when the soil is frozen or has an adequate snow cover. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. The loss of tree seedlings is caused by wetness. Special harvest methods may be needed to control the undesirable plants. Because of wetness, severe seedling mortality, and plant competition, trees are not planted on this soil.

This soil is generally unsuited to building site development because of the wetness and ponding.

The land capability classification is IIw. The woodland ordination symbol is 7W. The Michigan soil management group is 2.5c.

36B—Alcona loamy fine sand, 2 to 6 percent slopes. This undulating, well drained soil is on broad

upland plains. Individual areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The subsurface layer is pale brown very fine sandy loam about 3 inches thick. The subsoil is about 36 inches thick. The upper part is mixed dark yellowish brown and pale brown, friable very fine sandy loam; the next part is yellowish brown and brownish yellow, very friable loamy very fine sand and loamy fine sand; and the lower part is dark brown, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, stratified silt loam and loamy very fine sand.

Included with this soil in mapping are small areas of the well drained Nester soils and the somewhat poorly drained Belding soils. Nester soils are in landscape positions similar to those of the Alcona soil. They have more clay throughout than the Alcona soil. Belding soils are in depressions and on foot slopes. Included soils make up 0 to 10 percent of the unit.

Permeability of this Alcona soil is moderate. Available water capacity also is moderate. Runoff is slow.

Most areas of this soil are wooded. A few areas are used as pasture or cropland.

This soil is well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rains. A cropping system that includes close-growing crops in the cropping system helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility of the soil to soil blowing. Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concern is plant competition. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

Subsequent control of the invasion and growth of hardwoods may be needed.

This soil is well suited to building site development.

The land capability classification is IIe. The woodland ordination symbol is 3L. The Michigan soil management group is 3a-s.

37A—Ingalls sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsurface layer is pinkish gray sand about 10 inches thick. The subsoil is dark brown, friable loamy sand about 10 inches thick. The substratum to a depth of about 60 inches is yellowish brown, pinkish gray, and light brown, stratified loamy very fine sand, very fine sandy loam, sandy loam, and sand.

Included with this soil in mapping are small areas of Iosco and Tonkey soils. Iosco soils have more clay in the substratum than the Ingalls soil. They are in landscape positions similar to those of the Ingalls soil. Tonkey soils are poorly drained and are in depressions and natural drainageways. Included soils make up 0 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Ingalls soil and moderately slow in the substratum. Available water capacity is low. Runoff is very slow. The seasonal high water table is at a depth of 6 inches to 1.5 feet from fall to spring.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are wetness, soil blowing, droughtiness, and the organic matter content. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water after heavy rains. Tile should be protected with suitable material that keeps them from filling with fine sand. Erosion-control structures may be needed where the surface ditches enter established drainageways. A system of conservation tillage that leaves all or part of the crop residue on the surface is effective in conserving moisture and controlling soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. The major management concerns are seasonal wetness and droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture,

overgrazing can reduce the extent of the plant cover and increase the susceptibility of the soil to soil blowing. Proper stocking rates, controlled grazing, and restricted grazing during wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during these periods. Deep ruts expose tree roots and alter soil structure. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. Year-round logging roads should be provided with roadfill and a gravel base. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is limited because of the wetness. Measures that stabilize the landings may be needed.

Because of the wetness, seedling losses can be a concern and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvesting methods may be needed to control the undesirable plants. If trees are planted, mechanical or chemical measures are needed to control the undesirable plants.

This soil is poorly suited to building site development because of the wetness. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements from water.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is 3b-s.

38—Tonkey sandy loam. This nearly level, poorly drained soil is in depressions and on broad flats in the uplands. Individual areas are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is black sandy loam about 7 inches thick. The subsoil is about 10 inches thick. The upper part is grayish brown, very friable loamy sand; the next part is light brownish gray, mottled, friable sandy loam; and the lower part is light yellowish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is light yellowish brown, light brownish gray, pale brown, and gray, stratified fine

sand, very fine sand, loam, and silt loam. In places the surface layer is muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Ingalls soils. These soils are on low knolls. They make up 0 to 10 percent of the unit.

Permeability of this Tonkey soil is moderately rapid. Available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Most areas are idle or are wooded. Because of wetness, this soil is generally unsuited to use as cropland and is poorly suited to pasture. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The soil is wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts tend to restrict lateral drainage, expose tree roots, and alter soil structure. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. Year-round logging roads should be provided with roadfill and a gravel base. Culverts are needed to maintain the natural drainage system. The number of landing sites is severely limited because of the wetness.

Because of the seasonal high water table, seedling losses are a concern and trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Because of the wetness, seedling mortality, and plant competition, trees generally are not planted on this soil.

This soil is generally unsuited to building site development because of the wetness and ponding.

The land capability classification is Vw. The woodland ordination symbol is 5W. The Michigan soil management group is 3c-s.

39—Pits, gravel. This map unit consists of open excavations from which sand and gravel have been

removed. The exposed underlying material supports few or no plants. The side slopes at the outer edges of these excavations vary in steepness. Individual areas are irregular in shape and range from 4 to more than 100 acres in size.

Most areas of this unit are used for wildlife habitat or are still being mined. A few areas are used for recreation. A few pits contain small deposits of rubbish and trash. Onsite investigation is necessary to determine the hazards and limitations affecting specific uses.

This unit is not assigned to interpretive groups.

42C—Nester-Mancelona complex, 6 to 12 percent slopes. These gently rolling soils are on knolls and ridges. The Nester soil is well drained, and the Mancelona soil is somewhat excessively drained. Individual areas are irregular in shape and range from 10 to 80 acres in size. They are about 40 to 60 percent Nester sandy loam and 30 to 50 percent Mancelona sand. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is firm. The upper part is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion. In some areas the substratum is gravelly or sandy.

Typically, the Mancelona soil has a surface layer of black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown gravelly sand, very gravelly sand, and sand. In some places depth to the substratum is more than 40 inches. In other places the subsoil has less clay.

Included with these soils in mapping are small areas of the well drained Menominee and excessively drained Rubicon soils. These included soils are in landscape positions similar to those of the Nester and Mancelona soils. Menominee soils are sandy in the upper part and loamy in the lower part of the subsoil and in the substratum. Rubicon soils are sand throughout.

Included soils make up 0 to 20 percent of the unit.

Permeability is slow in the Nester soil. It is moderately rapid in the upper part of the Mancelona soil and very rapid in the lower part. Available water capacity is high in the Nester soil and low in the Mancelona soil. Runoff is medium on the Nester soil and slow on the Mancelona soil. The shrink-swell potential is moderate in the Nester soil.

Most areas of these soils are used as cropland. A few areas are used as pasture or woodland.

These soils are moderately well suited to corn, oats, winter wheat, and alfalfa hay. The major management concerns are water erosion, soil blowing, droughtiness, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rainfall. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, increase the available water capacity.

These soils are well suited to pasture. The management concerns are surface compaction on the Nester soil and droughtiness in the Mancelona soil. During the summer months, when the Mancelona soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Overgrazing on the Nester soil results in compaction. Proper stocking rates, rotation or strip grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

If these soils are used as woodland, the major management concerns are the equipment limitation and plant competition on both soils and seedling mortality on the Mancelona soil. The use of equipment is restricted on the Nester soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Loose sand in heavily traveled areas of the Mancelona soil can interfere with the traction of wheeled equipment, especially during dry periods. The loss of tree seedlings is caused by droughtiness in the Mancelona soil. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent

the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

These soils are moderately well suited to building site development. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling of the Nester soil.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Nester soil is 3L, and that assigned to the Mancelona soil is 3S. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Mancelona soil is 4a.

43B—East Lake sand, 0 to 6 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on broad upland plains. Individual areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is very dark grayish brown and brown sand about 2 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brownish yellow, very friable sand. The lower part is brownish yellow, loose sand. The substratum to a depth of about 60 inches is yellowish brown very gravelly coarse sand. In some places a clay accumulation is in the lower part of the subsoil. In other places the content of gravel in the substratum is less than 15 percent.

Included with this soil in mapping are the somewhat excessively drained Graycalm and well drained Menominee soils. These soils are in landscape positions similar to those of the East Lake soil. Graycalm soils have less gravel in the substratum than the East Lake soil. They have bands of clay accumulation in the subsoil. Menominee soils have loamy material in the lower part of the subsoil and in the substratum. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of this East Lake soil and very rapid in the substratum. Available water capacity is low. Runoff is very slow.

Because of droughtiness, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Soil blowing and the organic matter content are management concerns. Small grain crops that are planted in fall or early in spring can make good use of the limited amount of available water. Conservation tillage, which does not invert the soil and leaves all or part of the crop residue on the surface, helps to control soil blowing. Cover crops, buffer strips,

and vegetative barriers also help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is the droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Most areas of this soil are wooded. The major concerns in managing woodland are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock helps to reduce the seedling mortality rate. Replanting generally is needed in some areas.

This soil is well suited to building site development.

The land capability classification is IVs. The woodland ordination symbol is 2S. The Michigan soil management group is 5a.

44B—Croswell sand, loamy substratum, 0 to 3 percent slopes. This nearly level, moderately well drained soil is on low knolls and broad uplands. Individual areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is very dark gray sand about 5 inches thick. The subsurface layer is grayish brown sand about 5 inches thick. The subsoil is loose sand about 20 inches thick. The upper part is brown, and the lower part is strong brown and mottled. The upper part of the substratum is light yellowish brown, mottled sand. The lower part to a depth of about 60 inches is strong brown, mottled, stratified very fine sand and silt loam. In some places the entire substratum is sandy. In other places the soil has no mottles.

Included with this soil in mapping are small areas of the somewhat poorly drained Au Gres soils and the poorly drained Roscommon soils. Au Gres soils are on low knolls. Roscommon soils are in depressions and along drainageways. Included soils make up 0 to 10 percent of the unit.

Permeability is rapid in the sandy layers of this Croswell soil and moderately slow in the lower part of the substratum. Available water capacity is low. Runoff is very slow. The seasonal high water table is at a depth of 2.5 to 5.0 feet from fall through spring.

Most areas of this soil are wooded. A few areas are used as cropland or pasture.

Because of droughtiness, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Soil blowing and the organic matter content are management concerns. Small grain crops that are planted in fall or early in spring can make good use of the limited amount of available water. Cover crops, buffer strips, vegetative barriers, windbreaks, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, conserve soil moisture.

This soil is moderately well suited to pasture. The major management concern is the droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting generally is needed in some areas. Undesirable plants that invade clearcut areas may delay the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is poorly suited to building site development because of the seasonal wetness. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements from water.

The land capability classification is IVs. The woodland ordination symbol is 7S. The Michigan soil management group is 5a.

45—Wheatley mucky loamy sand. This nearly level, poorly drained soil is on broad flats and in depressions and drainageways. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is black mucky loamy sand about 10 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and light brownish gray, mottled sand, gravelly sand, and very gravelly sand. In some areas the

surface layer is muck. In other areas the substratum is not gravelly.

Included with this soil in mapping are small areas of the somewhat excessively drained Mancelona soils on knolls and ridges and the somewhat poorly drained Gladwin soils on low knolls. Included soils make up 0 to 15 percent of the unit.

Permeability of this Wheatley soil is rapid. Available water capacity is low. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Most areas are wooded. Because of wetness, this soil is generally unsuited to use as cropland and is poorly suited to pasture. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used when the soil is wet. Equipment should be used only during dry summer months and during winter months when the snow cover is adequate. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of the wetness, severe seedling mortality, and plant competition, trees generally are not planted on this soil.

This soil is generally unsuited to building site development because of the wetness and ponding.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is 5c.

46B—Mancelona sand, 0 to 6 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on knolls, ridges, and broad flats in the uplands. Individual areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36

inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown very gravelly sand, gravelly sand, and sand. In some places depth to the substratum is more than 40 inches. In other places the subsoil has less clay.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm soils and the well drained Manistee and Montcalm soils. Graycalm soils are sandy throughout. Manistee soils have a loamy substratum. Montcalm soils have more clay in the upper part of the subsoil than the Mancelona soil. The included soils are in landscape positions similar to those of the Mancelona soil. They make up 0 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of this Mancelona soil and very rapid in the substratum. Available water capacity is low. Runoff is very slow.

Most areas of this soil are wooded. A few areas are used as cropland.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are droughtiness, soil blowing, and the organic matter content. Small grain crops that are planted in fall or early in spring can make good use of the limited amount of available water. Cover crops, buffer strips, vegetative barriers, windbreaks, and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, conserve soil moisture.

This soil is well suited to pasture. The major management concern is droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted,

site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is well suited to building site development.

The land capability classification is IIIs. The woodland ordination symbol is 5S. The Michigan soil management group is 4a.

46C—Mancelona sand, 6 to 18 percent slopes. This gently rolling and rolling, somewhat excessively drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown very gravelly sand, gravelly sand, and sand. In some places depth to the substratum is more than 40 inches. In other places the subsoil has less clay.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm soils and the well drained Manistee and Montcalm soils. Graycalm soils are sandy throughout. Manistee soils have a loamy substratum. Montcalm soils have more clay in the upper part of the subsoil than the Mancelona soil. The included soils are in landscape positions similar to those of the Mancelona soil. They make up 0 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of this Mancelona soil and very rapid in the substratum. Available water capacity is low. Runoff is slow.

Most areas of this soil are wooded. A few areas are used for crops and pasture.

Because of droughtiness and the hazard of water erosion, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, and the organic matter content are management concerns. Small grain crops that are planted in fall or early in spring can make good use of the limited amount of available water. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing crops help to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue,

green manure, and manure, conserve soil moisture.

This soil is moderately well suited to pasture. The major management concerns are water erosion and droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the runoff rate. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is IVe. The woodland ordination symbol is 5S. The Michigan soil management group is 4a.

46E—Mancelona sand, 18 to 35 percent slopes. This hilly and steep, somewhat excessively drained soil is on knolls and ridges in the uplands. Individual areas are elongated or irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown very gravelly sand, gravelly sand, and sand. In some places depth to the substratum is more than 40 inches. In other places the subsoil has less clay.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm soils and the well drained Manistee and Montcalm soils. Graycalm soils have bands in the subsoil. The combined thickness of these bands is less than 6 inches. Manistee soils have a loamy substratum. Montcalm soils have more clay in the upper part of the



Figure 8.—Regeneration of aspen in an area of Mancelona sand, 18 to 35 percent slopes, that has been clearcut.

subsoil than the Mancelona soil. The included soils are in landscape positions similar to those of the Mancelona soil. They make up 0 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of this Mancelona soil and very rapid in the substratum. Available water capacity is low. Runoff is slow.

This soil is used as woodland (fig. 8). It is generally

unsuited to use as cropland or pasture because of the hazard of water erosion, droughtiness, and the slope.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with the traction of

wheeled equipment, especially during dry periods. Logging roads should be stabilized. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 5R. The Michigan soil management group is 4a.

46F—Mancelona sand, 35 to 50 percent slopes.

This very steep, somewhat excessively drained soil is on ridges in the uplands. Individual areas are elongated and range from 3 to 20 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown and brownish yellow, very friable sand. The lower part is dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, brown, and very pale brown very gravelly sand, gravelly sand, and sand. In some places depth to the substratum is more than 40 inches. In other places the subsoil has less clay.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm soils. These soils have bands in the subsoil. The combined thickness of these bands is less than 6 inches. The included soils are in landscape positions similar to those of the Mancelona soil. They make up 0 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of this Mancelona soil and very rapid in the substratum. Available water capacity is low. Runoff is medium.

This soil is used as woodland. It is generally unsuited

to use as cropland or pasture because of the hazard of water erosion, droughtiness, and the slope.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. Loose sand and the slope can interfere with the traction of wheeled equipment. Special logging methods, such as yarding the logs with a cable, may be needed. Because of the hazard of erosion, skid roads and skid trails should be established on the contour and water should be removed with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. Because of the slope, trees are generally not planted on this soil.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 5R. The Michigan soil management group is 4a.

47A—Gladwin sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad upland plains. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is grayish brown sand about 6 inches thick. The subsoil is about 13 inches thick. The upper part is brown, mottled, very friable sand. The lower part is dark brown, mottled, friable gravelly sandy loam. The substratum to a depth of about 60 inches is brown and grayish brown sand and gravelly coarse sand. In some places the subsoil has an accumulation of clay. In other places the soil has no gravelly material.

Included with this soil in mapping are small areas of the somewhat excessively drained Mancelona soils on knolls and ridges and the poorly drained Wheatley soils in drainageways and depressions. Included soils make up 0 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of this Gladwin soil and very rapid in the substratum. Available water capacity is low. Runoff is very slow. The seasonal high water table is at a depth of 6 inches to 1.5 feet from late fall to spring.

Most areas of this soil are used as cropland or pasture. A few areas are wooded.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are wetness, soil blowing, the organic matter content, and droughtiness. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow ditches are effective in removing surface water after heavy rains. Erosion-control structures may be needed where the ditches enter established drainageways. A system of conservation tillage that leaves all or part of the crop residue on the surface is effective in conserving moisture and controlling soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content and conserve soil moisture.

This soil is well suited to pasture. The major management concerns are seasonal wetness and droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted grazing during wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts expose tree roots and alter soil structure. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled and should be drained by culverts. The number of suitable landing sites is severely limited because of the wetness. Measures that stabilize the landings may be needed.

Because of the wetness, seedling losses can be a concern and the trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvesting methods may be needed to control the undesirable plants. If trees are planted, mechanical or chemical measures are needed to control undesirable plants.

This soil is poorly suited to building site development because of the wetness. Suitable fill material can be

used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements from water.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is 4b.

48—Epoufette mucky sand. This nearly level, poorly drained soil is in drainageways and depressions. Individual areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is black mucky sand about 7 inches thick. The subsoil is about 18 inches thick. It is mottled. The upper part is dark grayish brown, friable gravelly loamy sand. The lower part is grayish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is light brownish gray gravelly sand. In some places the soil has no gravelly material. In other places the subsoil is sand. In some areas the surface layer is muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Gladwin soils and the poorly drained Brevort soils. Gladwin soils are on low knolls. Brevort soils are in landscape positions similar to those of the Epoufette soil. They have a loamy substratum. Included soils make up 0 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of this Epoufette soil and very rapid in the substratum. Available water capacity is low. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Most areas of this soil are wooded. A few areas are used as cropland.

Because of wetness, this soil is generally unsuited to use as cropland and is poorly suited to pasture. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Restricted grazing during wet periods helps to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The soil is usually wet from fall to spring and can be wet during other periods. Equipment can be used only during dry summer months and during winter months when the snow cover is adequate. Year-round logging roads should be provided with roadfill and a gravel base. Culverts are needed to maintain the natural drainage system. The number of suitable landing sites is severely limited by the wetness. Because of the wetness, seedling losses can be a concern and the trees are shallow rooted. Many trees

may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable plants. Trees generally are not planted on this soil because of the wetness and plant competition.

This soil is generally unsuited to building site development because of the wetness.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is 4c.

49A—Colonville silt loam, 0 to 3 percent slopes.

This nearly level, somewhat poorly drained soil is along rivers and streams. It is subject to flooding. Individual areas are elongated and range from about 5 to 150 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 11 inches thick. The upper part of the substratum is brown, stratified loamy sand, loam, and sandy loam. The next part is dark brown sandy loam. The lower part to a depth of about 60 inches is gray fine sand. In some places the surface layer is thinner. In other places the lower part of the substratum has more clay.

Included with this soil in mapping are small areas of the poorly drained Ewart soils on the lower parts of the landscape and the very poorly drained Tawas soils in depressions. Included soils make up 0 to 10 percent of the unit.

Permeability of this Colonville soil is moderately rapid. Available water capacity is moderate. Runoff is slow. The seasonal high water table is within 1 to 2 feet of the surface from fall to spring.

Most areas are used as woodland. Because of the flooding, this soil is generally unsuited to use as cropland and is poorly suited to pasture. The major concerns in managing pasture are the flooding, surface compaction, and wetness. The only suitable pasture plants are those that tolerate wetness. Overgrazing or grazing when the soil is wet causes surface compaction and destroys the cover of forage plants. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The major concerns in managing woodland are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is restricted in spring and in other excessively wet periods. Equipment should

be used only when the soil is dry or has an adequate snow cover. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Because of the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is unsuited to building site development because of the flooding.

The land capability classification is Vw. The woodland ordination symbol is 3W. The Michigan soil management group is L-2b.

50B—Menominee sand, 0 to 6 percent slopes. This nearly level to undulating, well drained soil is on knolls and broad uplands. Individual areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is strong brown, firm clay loam and brown sandy loam. The substratum to a depth of 60 inches is brown clay loam. In some places depth to the loamy material is more than 40 inches. In other places the substratum has more clay.

Included with this soil in mapping are small areas of the well drained Nester soils and the somewhat excessively drained Graycalm soils. Nester soils have more clay throughout than the Menominee soil. Graycalm soils are sandy throughout. The included soils are in landscape positions similar to those of the Menominee soil. They make up 0 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Menominee soil and moderately slow in the loamy layers. Available water capacity is moderate. Runoff is very slow. The shrink-swell potential is moderate in the lower part of the subsoil and in the substratum.

Most areas of this soil are used as cropland or woodland. A few areas are used as pasture.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are droughtiness, soil blowing, and the organic matter content. Small grain crops that are seeded in fall or early in spring can make good use of the limited amount of available water. Additions of organic material,

such as crop residue, green manure, and manure, conserve soil moisture and help to maintain or increase the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing.

This soil is well suited to pasture. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay the establishment of desired species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is well suited to building site development.

The land capability classification is IIIs. The woodland ordination symbol is 6S. The Michigan soil management group is 4/2a.

50C—Menominee sand, 6 to 12 percent slopes.

This gently rolling, well drained soil is on knolls and broad uplands. Individual areas are irregular in shape and range from 3 to 600 acres in size.

Typically, the surface layer is very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is strong brown, firm clay loam and brown sandy loam. The substratum to a depth of 60 inches is brown clay loam. In some places depth to the loamy material is more than 40 inches. In other places the substratum has more clay.

Included with this soil in mapping are small areas of the well drained Nester soils and the somewhat excessively drained Graycalm soils. Nester soils have more clay throughout than the Menominee soil. Graycalm soils are sandy throughout. The included soils are in landscape positions similar to those of the Menominee soil. They make up 0 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Menominee soil and moderately slow in the loamy layers. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is moderate in the lower part of the subsoil and in the substratum.

Most areas of this soil are used as cropland or woodland. A few areas are used as pasture.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing crops help to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gully. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. The major management concerns are water erosion and soil blowing. Overgrazing during very dry periods can destroy the plant cover and can increase the susceptibility to soil blowing and water erosion. Maintaining an adequate plant cover by preventing overgrazing helps to control water erosion and soil blowing.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is moderately well suited to building site development. The slope is a limitation. Some land grading may be needed.

The land capability classification is IIIe. The woodland ordination symbol is 6S. The Michigan soil management group is 4/2a.

50D—Menominee sand, 12 to 18 percent slopes.

This rolling, well drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is strong brown, firm clay loam and brown sandy loam. The substratum to a depth of 60 inches is brown clay loam. In some places depth to the loamy material is more than 40 inches. In other places the substratum has more clay.

Included with this soil in mapping are small areas of the well drained Nester soils and the somewhat excessively drained Graycalm soils. Nester soils have more clay throughout than the Menominee soil. Graycalm soils are sandy throughout. The included soils are in landscape positions similar to those of the Menominee soil. They make up 0 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Menominee soil and moderately slow in the loamy layers. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is moderate in the lower part of the subsoil and in the substratum.

Most areas of this soil are wooded. A few areas are used as pasture or cropland.

Because of the hazard of water erosion, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is water erosion. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to water erosion. Maintaining an adequate plant cover by preventing overgrazing helps to control runoff and erosion.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree

seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is only moderately well suited to building site development because of the slope. Some land grading may be needed.

The land capability classification is IVe. The woodland ordination symbol is 6S. The Michigan soil management group is 4/2a.

50E—Menominee sand, 18 to 35 percent slopes.

This hilly and steep, well drained soil is on ridges and hills in the uplands. Individual areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is strong brown, firm clay loam and brown sandy loam. The substratum to a depth of 60 inches is brown clay loam. In some places depth to the loamy material is more than 40 inches. In other places the substratum has more clay.

Included with this soil in mapping are small areas of the well drained Nester soils and the somewhat excessively drained Graycalm soils. Nester soils have more clay throughout than the Menominee soil. Graycalm soils are sand throughout. The included soils are in landscape positions similar to those of the Menominee soil. They make up 0 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Menominee soil and moderately slow in the loamy layers. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is moderate in the lower part of the subsoil and in the substratum.

Most areas are wooded. Because of the slope and the hazard of water erosion, this soil is generally unsuited to use as cropland or pasture.

The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of

suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation.

This soil is generally unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 6R. The Michigan soil management group is 4/2a.

51B—Iosco sand, 0 to 4 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on low knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is brown sand about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, mottled, loose sand. The lower part is dark brown, mottled, friable sandy loam. The substratum to a depth of 60 inches is reddish brown, mottled silty clay loam. In places the loamy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Brevort soils, the somewhat poorly drained Kawkawlin soils, and the well drained Menominee soils. Brevort soils are in depressions and along drainageways. Kawkawlin soils have more clay in the subsoil than the Iosco soil. They are on low knolls. Menominee soils are on knolls and ridges. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Iosco soil and moderately slow in the loamy layers. Available water capacity is moderate. Runoff is very slow. The seasonal high water table is at a depth of 6 inches to 1.5 feet from fall to spring. The shrink-swell potential is moderate in the substratum.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns

are wetness, soil blowing, and the organic matter content. Surface and subsurface drainage systems are needed to reduce the wetness. Shallow ditches are effective in removing surface water after heavy rains. Erosion-control structures may be needed where the ditches enter established drainageways. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, or manure, help to maintain or increase organic matter content.

This soil is well suited to pasture. The major management concerns are seasonal wetness and droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted grazing during wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts expose tree roots and alter soil structure. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled and should be drained by culverts. Landing sites are generally available during the driest periods. Measures that stabilize the landings may be needed. Because of the wetness, seedling losses can be a concern and the trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied.

This soil is poorly suited to building site development because of the wetness. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is 4/2b.

52—Brevort mucky loamy sand. This nearly level, poorly drained soil is in depressions and along drainageways. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is black mucky loamy sand about 5 inches thick. The substratum extends to a depth of about 60 inches. The upper part is brown, light brownish yellow, yellowish brown, and light brownish gray, mottled sand, and the lower part is grayish brown, mottled silty clay loam. In some places the lower part of the substratum has more clay. In other places the surface layer is sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Iosco soils and the poorly drained Sims soils. Iosco soils are slightly higher on the landscape than the Brevort soil. Sims soils have a fine textured subsoil. They are in landscape positions similar to those of the Brevort soil. Included soils make up 0 to 10 percent of the unit.

Permeability is rapid in the sandy layers of this Brevort soil and moderately slow in the loamy layers. Available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring. The shrink-swell potential is moderate in the lower part of the substratum.

Most areas are wooded. Because of wetness and ponding, this soil is generally unsuited to use as cropland and is poorly suited to pasture. The major concern in managing pasture is the wetness. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Restricted grazing during wet periods helps to keep the pasture in good condition.

The major concerns in managing woodland are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The soil is wet from fall to spring and can be wet during other periods. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. Year-round logging roads should be provided with roadfill and a gravel base and should be drained by culverts. The number of suitable landing sites is severely limited by the wetness. Because of the wetness, seedling losses can be a concern and the trees are shallow rooted. Many trees may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to prevent or delay natural regeneration unless precautionary measures are applied. Special harvest methods may be needed to control the undesirable

plants. Trees are generally not planted on this soil because of the wetness and plant competition.

This soil is generally unsuited to building site development because of the wetness.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is 4/2c.

53B—Manistee loamy sand, 0 to 6 percent slopes.

This nearly level and undulating, well drained soil is on knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 11 inches thick. The subsurface layer is light brownish gray sand about 4 inches thick. The subsoil is about 35 inches thick. The upper part is brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In wooded areas the surface layer is thinner. In some places the sandy layers extend to a depth of more than 40 inches. In other places the substratum has less clay.

Included with this soil in mapping are some areas of the somewhat poorly drained Allendale soils and the moderately well drained Croswell soils. Allendale soils have a mottled subsoil. They are in slightly depressional areas. Croswell soils are more than 40 inches deep to clayey material. They are in landscape positions similar to those of the Manistee soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Manistee soil and very slow in the clayey layers. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high in the lower part of the subsoil and in the substratum.

Most areas of this soil are used as cropland or woodland. A few areas are used as pasture.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are soil blowing and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper

stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concern is plant competition. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

This soil is moderately well suited to building site development. The high shrink-swell potential in the lower part of the subsoil and in the substratum is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIs. The woodland ordination symbol is 6A. The Michigan soil management group is 4/1a.

53C—Manistee loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The subsurface layer is light brownish gray sand about 4 inches thick. The subsoil is about 35 inches thick. The upper part is reddish brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In wooded areas the surface layer is thinner. In some places the sandy layers extend to a depth of more than 40 inches. In other places the substratum has less clay.

Included with this soil in mapping are some areas of the somewhat poorly drained Allendale soils in drainageways and the moderately well drained Croswell soils in depressions. Croswell soils do not have a clayey substratum. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Manistee soil and very slow in the clayey layers. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high in the lower part of the subsoil and in the substratum.

Most areas of this soil are used as cropland or woodland. A few areas are used as pasture.

This soil is moderately well suited to corn, oats, winter wheat, and alfalfa hay. The major management concerns are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing

crops help to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gully erosion. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. The major management concerns are water erosion and soil blowing. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Maintaining an adequate cover by preventing overgrazing helps to control water erosion and soil blowing.

Where this soil is used as woodland, the major management concern is plant competition. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

This soil is moderately well suited to building site development. The slope and the high shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol is 6A. The Michigan soil management group is 4/1a.

53D—Manistee loamy sand, 12 to 18 percent slopes. This rolling, well drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 5 inches thick. The subsurface layer is light brownish gray sand about 6 inches thick. The subsoil is about 31 inches thick. The upper part is reddish brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In some places the sandy layers extend to a depth of more than 40 inches. In other places the substratum has less clay.

Included with this soil in mapping are some small areas of the excessively drained Rubicon soils. These soils are sandy throughout. They are in landscape positions similar to those of the Manistee soil. They make up 0 to 10 percent of the unit.

Permeability is rapid in the sandy layers of this Manistee soil and very slow in the clayey layers. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high in the lower part of the

subsoil and in the substratum.

Most areas of this soil are wooded. A few areas are used as cropland or pasture.

Because of the hazard of water erosion, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing crops help to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is water erosion. Maintaining an adequate cover by preventing overgrazing helps to control runoff and water erosion.

The major management concern in the areas used as woodland is plant competition. Undesirable plants that invade clearcut areas can delay the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

This soil is moderately well suited to building site development. The slope and the high shrink-swell potential are limitations. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IVe. The woodland ordination symbol is 6A. The Michigan soil management group is 4/1a.

54B—Allendale loamy sand, 0 to 4 percent slopes.

This nearly level and undulating, somewhat poorly drained soil is on low knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is very dark gray loamy sand about 5 inches thick. The subsurface layer is gray sand about 3 inches thick. The subsoil is about 21 inches thick. The upper part is yellowish brown, mottled, very friable loamy sand; the next part is brown, mottled, friable clay loam and light brownish gray, friable sandy loam; and the lower part is dark grayish brown, mottled, firm clay. The substratum to a depth of 60 inches is weak red, mottled silty clay. In places the substratum has less clay.

Included with this soil in mapping are small areas of

the moderately well drained Croswell soils, the somewhat poorly drained Selkirk soils, and the well drained Manistee soils. Croswell and Manistee soils are on knolls and ridges. Selkirk soils have a loamy surface layer. They are in landscape positions similar to those of the Allendale soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Allendale soil and slow in the clayey layers. Available water capacity is moderate. Runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from fall to spring. The shrink-swell potential is high in the lower part of the subsoil and in the substratum.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are soil blowing, wetness, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water after heavy rains. Erosion-control structures may be needed where the ditches enter established drainageways. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. The major management concern is the wetness. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, and plant competition. The use of equipment is limited in fall and spring and in other excessively wet periods. Ruts form easily if wheeled skidders are used during wet periods. Deep ruts expose tree roots and alter soil structure. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. When the soil is wet, unsurfaced roads are slippery and ruts can easily form. Year-round logging roads should be provided with roadfill and a gravel base. Culverts are needed to maintain the natural drainage system. The number of suitable

landing sites is limited because of the wetness. Measures that stabilize the landings may be needed. Because of the wetness, trees on this soil are shallow rooted. Many may be blown down during periods of high wind. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay natural regeneration unless precautionary measures are applied. Special harvesting methods may be needed to control the undesirable plants. If trees are planted, mechanical or chemical measures are needed to control undesirable plants.

This soil is poorly suited to building site development because of the wetness. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is 4/1b.

57A—Belding sandy loam, 0 to 3 percent slopes.

This nearly level, somewhat poorly drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is black and very dark gray sandy loam about 12 inches thick. The subsoil is mottled sandy loam about 14 inches thick. The upper part is dark brown and friable, and the lower part is brown and very friable. The substratum to a depth of 60 inches is dark grayish brown, mottled loam. In some places the surface layer is sandy. In other places the subsoil and substratum have more clay.

Included with this soil in mapping are small areas of the poorly drained Brevort soils in depressions and natural drainageways. These soils make up 0 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of this Belding soil and moderately slow in the lower part. Available water capacity is moderate. Runoff is slow. The seasonal high water table is at a depth of 6 inches to 1.5 feet from fall to spring. The shrink-swell potential is moderate in the substratum.

Most areas of this soil are wooded. A few areas are used as pasture or cropland.

This soil is well suited to use as cropland. The major management concerns are wetness, soil blowing, tilth, and the organic matter content. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water after heavy rains. Erosion-control structures may be needed where the ditches

enter established drainageways. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, buffer strips, vegetative barriers, and windbreaks help to control soil blowing and prevent crusting during periods of heavy rains. Minimizing tillage and tilling the soil at the proper moisture content help to prevent compaction. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is well suited to pasture. The major management concern is wetness. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Deep ruts can expose tree roots and damage soil structure. Equipment can be used only during dry summer months and during winter months when the snow cover is adequate. Because of the seasonal high water table, trees on this soil are shallow rooted. Some may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. The loss of tree seedlings is caused by wetness. Special site preparation, such as bedding before planting, reduces the seedling mortality rate. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants.

This soil is poorly suited to building site development because of the wetness and the moderate shrink-swell potential. Suitable fill material can be used to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIw. The woodland ordination symbol is 4W. The Michigan soil management group is 3/2b.

63—Evart sand. This nearly level, poorly drained soil

is along rivers and streams. It is subject to flooding. Individual areas are elongated and range from 5 to 90 acres in size.

Typically, the surface layer is about 14 inches of black sand and very dark gray, mottled sand. The substratum extends to a depth of about 60 inches. In sequence downward, it is grayish brown sand; dark grayish brown gravelly sand; brown, mottled sand; and gray, mottled sand. In some places the surface layer is thinner. In other places it is muck. In some areas the substratum is loamy.

Included with this soil in mapping are small areas of the somewhat poorly drained Colonville soils on low knolls and the very poorly drained Tawas soils in slight depressions. Included soils make up 5 to 15 percent of the unit.

Permeability of this Evart soil is rapid. Available water capacity is low. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Most areas of this soil are used as woodland. Because of flooding and ponding, this soil is generally unsuited to use as cropland or pasture.

The major management concerns in the areas used as woodland are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. This soil is wet from fall to spring and can be wet during other periods. Ruts form easily if wheeled skidders are used when the soil is wet. Deep ruts can expose tree roots and alter soil structure. Equipment can be used only during dry summer months and during winter months when the snow cover is adequate. Because of the seasonal high water table, trees on this soil are shallow rooted. Many are blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is generally unsuited to building site development because of the flooding.

The land capability classification is VIIw. The woodland ordination symbol is 2W. The Michigan soil management group is L-4c.

64B—Melita sand, 0 to 6 percent slopes. This nearly level and undulating, somewhat excessively

drained soil is on knolls and broad upland plains. Individual areas are irregular in shape and range from 3 to 120 acres in size.

Typically, the surface layer is black and very dark grayish brown sand about 2 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, dark yellowish brown, yellowish brown, and light yellowish brown, loose sand. The lower part is friable, mixed yellowish brown clay loam and pale brown very fine sandy loam. In places the loamy material is within a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm and Mancelona and well drained Klacking soils. These soils are in landscape positions similar to those of the Melita soil. Graycalm soils do not have loamy material within a depth of 60 inches. Mancelona soils are underlain by gravel. Klacking soils have loamy bands in the lower part of the subsoil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Melita soil and moderately slow in the loamy layers. Available water capacity is low. Runoff is very slow.

Because of droughtiness, this soil is poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Soil blowing and the organic matter content are management concerns. Small grain crops that are planted in fall or early in spring can make good use of the limited amount of available water. Conservation tillage, which does not invert the soil and leaves all or part of the crop residue on the surface, helps to control soil blowing. Cover crops, buffer strips, and vegetative barriers also help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

This soil is moderately well suited to pasture. The major management concern is droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Most areas of this soil are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized

seedlings or special nursery stock reduces the seedling mortality rate.

This soil is well suited to building site development.

The land capability classification is IVs. The woodland ordination symbol is 3S. The Michigan soil management group is 5/2a.

64C—Melita sand, 6 to 18 percent slopes. This gently rolling and rolling, somewhat excessively drained soil is on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is black and very dark grayish brown sand about 2 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, dark yellowish brown, yellowish brown, and light yellowish brown, loose sand. The lower part is friable, mixed yellowish brown clay loam and pale brown very fine sandy loam. In places the loamy material is within a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm and Mancelona and well drained Klacking soils. These soils are in landscape positions similar to those of the Melita soil. Graycalm soils do not have loamy material within a depth of 60 inches. Mancelona soils are underlain by gravel. Klacking soils have loamy bands in the lower part of the subsoil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy layers of this Melita soil and moderately slow in the loamy layers. Available water capacity is low. Runoff is slow.

Because of droughtiness and the hazards of water erosion and soil blowing, this soil is generally unsuited to use as cropland and is poorly suited to pasture. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Most areas of this soil are used as woodland. The major management concerns are the equipment limitation and seedling mortality. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate.

This soil is moderately well suited to building site

development. The slope is a limitation. Some land grading may be needed.

The land capability classification is VI_s. The woodland ordination symbol is 3S. The Michigan soil management group is 5/2a.

65—Arnheim silt loam. This nearly level, poorly drained soil is along streams and rivers. It is frequently flooded. Individual areas are long and narrow and range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 13 inches thick. The upper part of the substratum is dark gray silt loam. The next part is dark grayish brown sand. The lower part to a depth of about 60 inches is dark gray and very dark grayish brown, stratified silt loam and muck. In some areas the surface layer is muck. In other areas the substratum is sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Colonville soils and the poorly drained Sims soils. Colonville soils are slightly higher on the landscape than the Arnheim soil. Sims soils formed in unstratified material. They are in landscape positions similar to those of the Arnheim soil. Included soils make up 5 to 10 percent of the unit.

Permeability of this Arnheim soil is moderate. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Because of the flooding, this soil is generally unsuited to use as cropland and is poorly suited to pasture. The major concern in managing pasture is wetness. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and damages the cover of forage plants. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Most areas of this soil are used as woodland. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Equipment should be used only when the soil is relatively dry or has an adequate snow cover. The number of suitable landing sites is severely limited because of the wetness. Seedling losses are caused by the wetness and the flooding. Because of the high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. After trees are cut, plant competition can be expected to delay or prevent natural regeneration unless precautionary measures are applied. Special

harvest methods may be needed to control the undesirable plants. Trees are not generally planted on this soil because of wetness and plant competition.

This soil is unsuited to building site development because of the flooding.

The land capability classification is Vw. The woodland ordination symbol is 5W. The Michigan soil management group is L-2c.

70—Loxley peat. This nearly level, very poorly drained soil is in bogs, drainageways, and depressional areas in the uplands. It is subject to ponding. Individual areas range from 5 to 80 acres in size.

Typically, the surface layer is brown peat about 12 inches thick. Below this to a depth of about 60 inches is dark reddish brown and black muck. In places the organic layers are less acid.

Included with this soil in mapping are small areas of the very poorly drained Cathro, Dawson, and Rondeau soils. These soils are in landscape positions similar to those of the Loxley soil. Cathro and Dawson soils are near the edges of the mapped areas, and Rondeau soils are along streams. Cathro soils have a loamy substratum, Dawson soils have a sandy substratum, and Rondeau soils have a marly substratum. Included soils make up 5 to 15 percent of the unit.

Permeability of this Loxley soil is moderately slow to moderately rapid. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Most areas support water-tolerant grasses and sedges or wetland tree species. Because of wetness and instability, the soil is generally unsuitable for crops and pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. Equipment can be used during periods in winter when access roads are frozen. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds. The loss of tree seedlings is caused by wetness.

Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is unsuited to building site development

because of wetness, ponding, and low strength.

The land capability classification is VIIw. The woodland ordination symbol is 2W. The Michigan soil management group is Mc-a.

71—Dawson peat. This nearly level, very poorly drained soil is in bogs, drainageways, and depressional areas in the uplands. Individual areas range from 3 to 70 acres in size.

Typically, the surface layer is pale brown peat about 6 inches thick. Below this is about 29 inches of dark reddish brown mucky peat and very dark gray and black muck. The substratum extends to a depth of about 60 inches. The upper part is dark grayish brown loam. The lower part is light brownish gray sand. In some places the organic layers are less acid. In other places they are more than 50 inches thick.

Included with this soil in mapping are small areas of the very poorly drained Cathro and poorly drained Roscommon soils. These soils are in landscape positions similar to those of the Dawson soil. Cathro soils have a loamy substratum. Roscommon soils are sandy throughout. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layers of this Dawson soil and rapid in the substratum. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Most areas support water-tolerant grasses and sedges or wetland tree species. Because of wetness and instability, the soil is generally unsuitable for crops or pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. Equipment can be used during periods in winter when access roads are frozen. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is unsuited to building site development because of wetness, ponding, and low strength.

The land capability classification is VIIw. The woodland ordination symbol is 2W. The Michigan soil management group is M/4c.

74—Cathro muck. This nearly level, very poorly drained soil is in swamps, drainageways, and depressional areas in the uplands. Individual areas are irregular in shape and range from 3 to 90 acres in size.

Typically, the surface layer is black muck about 5 inches thick. The next 25 inches also is black muck. The substratum to a depth of about 60 inches is dark gray sandy loam. In some places the substratum is sandy. In other places it has more clay. In some areas the organic layers are more than 50 inches thick.

Included with this soil in mapping are small areas of the very poorly drained Rondeau soils. These soils are in landscape positions similar to those of the Cathro soil. They are underlain by marl. They make up 5 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layers of this Cathro soil and moderately slow or moderate in the substratum. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Because of wetness and instability, it is generally unsuited to crops and pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. Equipment can be used during periods in winter when access roads are frozen. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is unsuited to building site development because of wetness, ponding, and low strength.

The land capability classification is VIw. The woodland ordination symbol is 5W. The Michigan soil management group is M/3c.

76—Lupton muck. This nearly level, very poorly drained soil is in swamps, along drainageways, and in

depressional areas in the uplands. Individual areas are irregular in shape and range from 3 to 1,000 acres in size.

Typically, the surface layer is black muck about 4 inches thick. The underlying layers to a depth of about 60 inches also are black muck. In places the organic layers are more acid.

Included with this soil in mapping are small areas of the very poorly drained Cathro, Rondeau, and Tawas soils. These soils are in landscape positions similar to those of the Lupton soil. They generally are in areas between the Lupton soil and the adjacent mineral soils. Cathro soils are underlain by loam. Rondeau soils are underlain by marl. Tawas soils are underlain by sand. Included soils make up 5 to 15 percent of the unit.

Permeability of this Lupton soil is moderately slow to moderately rapid. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Because of wetness and instability, it is generally unsuitable for crops and pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. Equipment can be used during periods in winter when access roads are frozen. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is unsuited to building site development because of wetness, ponding, and low strength.

The land capability classification is VIw. The woodland ordination symbol is 2W. The Michigan soil management group is Mc.

77—Tawas mucky peat. This nearly level, very poorly drained soil is in swamps, along drainageways, and in depressional areas in the uplands. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is black mucky peat about 7 inches thick. Below this is about 24 inches of black muck. The substratum to a depth of about 60 inches is

dark grayish brown and light brownish gray sand. In some places the organic layers are more than 50 inches thick. In other places they are more acid.

Included with this soil in mapping are small areas of the very poorly drained Cathro and Rondeau soils. These soils are in landscape positions similar to those of the Tawas soil. Cathro soils are underlain by loamy material. Rondeau soils are underlain by marl. Included soils make up about 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layers of this Tawas soil and rapid in the substratum. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Because of wetness and instability, it is generally unsuitable for crops and pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. Equipment can be used during periods in winter when access roads are frozen. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is unsuited to building site development because of wetness, ponding, and low strength.

The land capability classification is VIw. The woodland ordination symbol is 5W. The Michigan soil management group is M/4c.

78—Rondeau muck. This nearly level, very poorly drained soil is in swamps, along drainageways, and in depressional areas in the uplands. Individual areas are irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is black muck about 4 inches thick. The next 16 inches also is black muck. The substratum to a depth of about 60 inches is light brownish gray and light gray marl. In some places the organic layers are more than 50 inches thick. In other places they are less than 16 inches thick.

Included with this soil in mapping are small areas of

the very poorly drained Cathro and Tawas soils. These soils are in landscape positions similar to those of the Rondeau soil. Cathro soils are underlain by loam. Tawas soils are underlain by sand. Included soils make up about 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layers of this Rondeau soil and slow or very slow in the layers of marl. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

This soil is used as woodland. Because of wetness and instability, it is generally unsuitable for crops and pasture.

The major concerns in managing woodland are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. Equipment can be used during periods in winter when access roads are frozen. Because of the seasonal high water table, trees on this soil are shallow rooted. Many may be blown down during periods of high winds and excessive wetness. The loss of tree seedlings is caused by wetness. Undesirable plants that invade clearcut areas may prevent the establishment of desired species. Special harvest methods may be needed to control the undesirable plants. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

This soil is unsuited to building site development because of wetness, ponding, and low strength.

The land capability classification is VIw. No woodland ordination symbol is assigned to this soil. The Michigan soil management group is M/mc.

79—Grousehaven muck. This nearly level, very poorly drained soil is in swamps, along drainageways, and in depressional areas in the uplands. Individual areas are irregular in shape and range from 3 to 220 acres in size.

Typically, the surface layer is black muck about 7 inches thick. The substratum to a depth of about 60 inches is white and light gray marl. In some places the organic layers are more than 16 inches thick. In other places the soil does not have an organic surface layer.

Included with this soil in mapping are small areas of the very poorly drained Cathro and Tawas soils. These soils are in landscape positions similar to those of the Grousehaven soil. Cathro soils are underlain by loamy material. Tawas soils are underlain by sand. Also

included are a few areas of abandoned pits and mines left after the removal of marl. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the surface layer of this Grousehaven soil and slow or very slow in the layers of marl. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or near the surface throughout the year.

Most areas of this soil support cattails, water-tolerant grasses and sedges, and wetland shrubs. Most areas do not support trees. Because of wetness and instability, the soil is generally unsuitable for crops and pasture.

This soil is unsuited to building site development because of wetness, ponding, and low strength.

The land capability classification is VIIw. No woodland ordination symbol is assigned to this soil. The Michigan soil management group is M/mc.

82B—Nester-Manistee complex, 2 to 6 percent slopes. These undulating, well drained soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 200 acres in size. They are 40 to 60 percent Nester soil and 30 to 50 percent Manistee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 23 inches thick. It is firm. The upper 5 inches is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion.

Typically, the Manistee soil has a surface layer of dark grayish brown loamy sand about 11 inches thick. The subsurface layer is light brownish gray sand about 4 inches thick. The subsoil is about 35 inches thick. The upper part is brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In some places the sandy layers are more than 40 inches thick. In other places the substratum has less clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin and Allendale soils in shallow depressions and on side slopes and the poorly drained Sims and Brevort soils in

depressions and drainageways. Included soils make up 5 to 20 percent of the unit.

Permeability is slow in the Nester soil. It is rapid in the upper part of the Manistee soil and very slow in the lower part. Available water capacity is high in the Nester soil and moderate in the Manistee soil. Runoff is medium on the Nester soil and slow on the Manistee soil. The Nester soil has a moderate shrink-swell potential. The Manistee soil has a high shrink-swell potential in the lower part of the subsoil and in the substratum.

Most areas of these soils are used as cropland or woodland. A few areas are used as pasture.

These soils are well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing crops help to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, such as rye, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

These soils are well suited to pasture. Overgrazing during very dry periods, however, increases the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where these soils are used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted on the Nester soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are only moderately well suited to building site development because of the shrink-swell potential. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIe. The woodland ordination symbol assigned to the Nester soil is 3L, and that assigned to the Manistee soil is 3A. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Manistee soil is 4/1a.

82C—Nester-Manistee complex, 6 to 12 percent slopes. These gently rolling, well drained soils are on knolls, on ridges, and in broad areas in the uplands. Individual areas are irregular in shape and range from 10 to 200 acres in size. They are 40 to 60 percent Nester soil and 30 to 50 percent Manistee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is firm. The upper 5 inches is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion.

Typically, the Manistee soil has a surface layer of dark grayish brown loamy sand about 11 inches thick. The subsurface layer is light brownish gray sand about 4 inches thick. The subsoil is about 35 inches thick. The upper part is brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In some places the sandy layers are more than 40 inches thick. In other places the substratum has less clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin and Allendale soils in shallow depressions and on the lower side slopes and the poorly drained Sims and Brevort soils in depressions and drainageways. Included soils make up 5 to 20 percent of the unit.

Permeability is slow in the Nester soil. It is rapid in the upper part of the Manistee soil and very slow in the lower part. Available water capacity is high in the Nester soil and moderate in the Manistee soil. Runoff is medium on the Nester soil and slow on the Manistee soil. The Nester soil has a moderate shrink-swell potential. The Manistee soil has a high shrink-swell potential in the lower part of the subsoil and in the substratum.

Most areas of these soils are used as cropland or woodland. A few areas are used as pasture.

These soils are moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing crops help to control water erosion and soil blowing. Grassed

waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, such as rye, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, and manure, help to maintain or increase the organic matter content.

These soils are well suited to pasture. Overgrazing during very dry periods, however, increases the susceptibility to soil blowing. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

Where these soils are used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly restricted on the Nester soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are only moderately well suited to building site development because of the slope and the shrink-swell potential. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Nester soil is 3L, and that assigned to the Manistee soil is 3A. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Manistee soil is 4/1a.

82D—Nester-Manistee complex, 12 to 18 percent slopes. These rolling, well drained soils are on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 10 to 100 acres in size. They are 40 to 60 percent Nester soil and 30 to 50 percent Manistee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown sandy loam about 4 inches thick. The subsoil is about 27 inches thick. It is firm. The upper 5 inches is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the mixed upper part of the subsoil does not occur or

has been destroyed by plowing or erosion.

Typically the Manistee soil has a surface layer of dark grayish brown loamy sand about 5 inches thick. The subsurface layer is light brownish gray sand about 6 inches thick. The subsoil is about 31 inches thick. The upper part is brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In some places the sandy layers are more than 40 inches thick. In other places the substratum has less clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin and Allendale soils in shallow depressions and on lower side slopes and the poorly drained Sims and Brevort soils in depressions and drainageways. Included soils make up 5 to 20 percent of the unit.

Permeability is slow in the Nester soil. It is rapid in the upper part of the Manistee soil and very slow in the lower part. Available water capacity is high in the Nester soil and moderate in the Manistee soil. Runoff is medium on the Manistee soil and rapid on the Nester soil. The Nester soil has a moderate shrink-swell potential. The Manistee soil has a high shrink-swell potential in the lower part of the subsoil and in the substratum.

Most areas of these soils are used as woodland. A few areas are used as cropland or pasture.

Because of the hazard of water erosion, these soils are poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface and a cropping system that includes close-growing crops help to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. Additions of organic material, such as crop residue, green manure, or manure, help to maintain or increase the organic matter content.

These soils are moderately well suited to pasture. Controlling water erosion and preventing compaction are management concerns. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Where these soils are used as woodland, the major management concerns are the equipment limitation and plant competition. The use of equipment is briefly

restricted on the Nester soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. The slope limits the number of suitable landing sites. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are poorly suited to building site development because of the slope and the shrink-swell potential. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IVe. The woodland ordination symbol assigned to the Nester soil is 3L, and that assigned to the Manistee soil is 3A. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Manistee soil is 4/1a.

82E—Nester-Manistee complex, 18 to 35 percent slopes. These deep, hilly and steep, well drained soils are on hills and ridges in the uplands. Individual areas are irregular in shape and range from 10 to 60 acres in size. They are 40 to 60 percent Nester soil and 30 to 50 percent Manistee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown sandy loam about 4 inches thick. The subsoil is about 27 inches thick. It is firm. The upper 5 inches is mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some areas the subsoil has more clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion.

Typically, the Manistee soil has a surface layer of dark grayish brown loamy sand about 5 inches thick. The subsurface layer is light brownish gray sand about 6 inches thick. The subsoil is about 35 inches thick. The upper part is brown, very friable sand; the next part is brown and dark brown, firm clay loam; and the lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is dark brown clay. In some places the sandy layers are more than 40 inches thick. In other places the substratum has less clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin and

Allendale soils in shallow depressions and on the lower side slopes and the poorly drained Sims and Brevort soils in depressions and drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Nester soil. It is rapid in the upper part of the Manistee soil and very slow in the lower part. Available water capacity is high in the Nester soil and moderate in the Manistee soil. Runoff is medium on the Manistee soil and rapid on the Nester soil. The Nester soil has a moderate shrink-swell potential. The Manistee soil has a high shrink-swell potential in the lower part of the subsoil and in the substratum.

These soils are used as woodland. They are generally unsuited to use as cropland or pasture because of the slope and the hazard of water erosion. The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and plant competition. The use of equipment is restricted because of the slope. On the Nester soil, it is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are generally unsuited to building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R. The Michigan management group assigned to the Nester soil is 1.5a, and that assigned to the Manistee soil is 4/1a.

83B—Rubicon-Menominee sands, 0 to 6 percent slopes. These nearly level and undulating soils are on knolls and low ridges in the uplands. The Rubicon soil is excessively drained, and the Menominee soil is well drained. Individual areas are irregular in shape and

range from 15 to 100 acres in size. They are 40 to 60 percent Rubicon soil and 40 to 60 percent Menominee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Rubicon soil has a surface layer of black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. Thin bands of loamy sand are below a depth of 40 inches. In some places the substratum is mottled and is gravelly. In other areas it is loamy. In some areas the soil does not have a dark brown layer.

Typically, the Menominee soil has a surface layer of very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; the lower part is firm, strong brown clay loam and brown sandy loam. The substratum to a depth of about 60 inches is brown clay loam. In some places the sandy layers are more than 40 inches thick. In other places the substratum has more clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and Iosco soils and the poorly drained Brevort and Roscommon soils. These included soils are in depressions. They make up 5 to 15 percent of the unit.

Permeability is rapid in the Rubicon soil. It is rapid in the upper part of the Menominee soil and moderately slow in the lower part. Available water capacity is low in the Rubicon soil and moderate in the Menominee soil. Runoff is very slow on both soils. The Menominee soil has a moderate shrink-swell potential in the lower part of the substratum.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species, especially on the

Menominee soil. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils generally are well suited to building site development. The moderate shrink-swell potential in the substratum of the Menominee soil is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is VI_s. The woodland ordination symbol is 6S. The Michigan soil management group assigned to the Rubicon soil is 5.3a, and that assigned to the Menominee soil is 4/2a.

83C—Rubicon-Menominee sands, 6 to 18 percent slopes. These gently rolling and rolling soils are on knolls and ridges in the uplands. The Rubicon soil is excessively drained, and the Menominee soil is well drained. Individual areas are irregular in shape and range from 20 to 350 acres in size. They are 40 to 60 percent Rubicon soil and 40 to 60 percent Menominee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Rubicon soil has a surface layer of black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. Thin bands of loamy sand are below a depth of 40 inches. In some areas the substratum is gravelly. In other areas it is loamy. In places the soil does not have a dark brown layer.

Typically, the Menominee soil has a surface layer of very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is firm, strong brown clay loam and brown sandy loam. The substratum to a depth of about 60 inches is brown clay loam. In some places the sandy layers are more than 40 inches thick. In other places the substratum has more clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and Iosco and poorly drained Brevort and Roscommon soils. These included soils are in depressions. They make up 5 to 20 percent of the unit.

Permeability is rapid in the Rubicon soil. It is rapid in the upper part of the Menominee soil and moderately

slow in the lower part. Available water capacity is low in the Rubicon soil and moderate in the Menominee soil. Runoff is slow on both soils. The Menominee soil has a moderate shrink-swell potential in the lower part of the substratum.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting generally is needed in some areas. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species, especially on the Menominee soil. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are only moderately well suited to building site development because of the slope. Some land grading may be needed.

The land capability classification is VII_s. The woodland ordination symbol is 6S. The Michigan soil management group assigned to the Rubicon soil is 5.3a, and that assigned to the Menominee soil is 4/2a.

83E—Rubicon-Menominee sands, 18 to 35 percent slopes. These hilly and steep soils are on hills and ridges in the uplands. The Rubicon soil is excessively drained, and the Menominee soil is well drained. Individual areas are irregular in shape and range from 5 to 10 acres in size. They are 40 to 60 percent Rubicon soil and 40 to 60 percent Menominee soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Rubicon soil has a surface layer of black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of 60 inches is light yellowish brown and yellowish brown sand. Thin bands of loamy sand are below a depth of 40 inches. In some areas the substratum is gravelly. In other areas it is loamy. In places the soil does not have a dark brown layer.

Typically, the Menominee soil has a surface layer of very dark grayish brown sand about 3 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The subsoil is about 32 inches thick. The

upper part is dark brown, friable sand; the next part is dark yellowish brown, friable sand; and the lower part is firm, strong brown clay loam and brown sandy loam. The substratum to a depth of about 60 inches is brown clay loam. In some places the sandy layers are more than 40 inches thick. In other places the substratum has more clay.

Included with these soils in mapping are small areas of the somewhat poorly drained Au Gres and Iosco and poorly drained Brevort and Roscommon soils. These included soils are in depressions. They make up 5 to 15 percent of the unit.

Permeability is rapid in the Rubicon soil. It is rapid in the upper part of the Menominee soil and moderately slow in the lower part. Available water capacity is low in the Rubicon soil and moderate in the Menominee soil. Runoff is slow on both soils. The Menominee soil has a moderate shrink-swell potential in the lower part of the substratum.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. The use of equipment is restricted because of the slope. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. The loss of tree seedlings is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Replanting generally is needed in some areas. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species, especially on the Menominee soil. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are generally unsuited to building site development because of the slope.

The land capability classification is VII_s. The woodland ordination symbol is 6R. The Michigan soil management group assigned to the Rubicon soil is 5.3a, and that assigned to the Menominee soil is 4/2a.

85B—Kent-Selkirk complex, 0 to 6 percent slopes.

These nearly level and undulating soils are on low knolls, ridges, and flats in the uplands. The Kent soil is moderately well drained, and the Selkirk soil is somewhat poorly drained. Individual areas are irregular in shape and range from 10 to 200 acres in size. They are about 50 to 70 percent Kent soil and 30 to 50 percent Selkirk soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Kent soil has a surface layer of dark grayish brown sandy loam about 9 inches thick. The subsoil is about 14 inches thick. The upper part is friable, strong brown clay mixed with brown sandy loam. The lower part is dark brown, very firm clay. The substratum to a depth of about 60 inches is brown, mottled clay. In some areas the subsoil has less clay. In other areas the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion.

Typically, the Selkirk soil has a surface layer of dark brown loam about 10 inches thick. The subsoil is dark brown, mottled, very firm clay about 6 inches thick. The substratum to a depth of about 60 inches is reddish brown and dark brown, mottled clay. In places the subsoil has less clay.

Included with these soils in mapping are small areas of the poorly drained Pickford soils. These included soils are in depressions and low areas. They make up 0 to 20 percent of the unit.

Permeability of the Kent and Selkirk soils is slow. Available water capacity is moderate. Runoff is medium on the Kent soil. It is slow or medium on the Selkirk soil. The shrink-swell potential is high in both soils.

Most areas of these soils are used as cropland or pasture. A few areas are wooded.

These soils are moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, wetness, and tilth. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and helps to prevent crusting during periods of heavy rainfall. Crop residue management and a cropping system that includes close-growing crops help to control water erosion. Grassed waterways, diversions, and erosion-control structures help to prevent gullying. Both surface and subsurface drainage systems are needed to reduce the wetness in low areas. Shallow ditches are effective in removing surface water after heavy rains. Erosion-control structures may be needed where the ditches enter established drainageways. Minimizing tillage or tilling the soils at the proper moisture content helps to prevent cloddiness and compaction.

These soils are well suited to pasture. The major management concerns are water erosion, wetness, and surface compaction. Maintaining an adequate plant cover by preventing overgrazing helps to control runoff and erosion. Overgrazing or grazing when the soils are too wet causes surface compaction and damages the cover of forage plants. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Where these soils are used as woodland, the major management concerns are the equipment limitation, the windthrow hazard, seedling mortality, and plant competition. The slow permeability and the sticky and plastic qualities of the subsoil limit the use of equipment in spring and in other excessively wet periods. Operating equipment during wet periods can result in compaction and can damage tree roots. When the soils are wet, unsurfaced roads and landings are slippery and ruts form easily. Year-round logging roads should be graveled and should be drained by culverts. Equipment can be used only during dry summer months and during winter months when the snow cover is adequate. Because of the seasonal high water table and the firm layer in the subsoil, trees on the Selkirk soil are shallow rooted. Some may be blown down during periods of high winds and excessive wetness. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are poorly suited to building site development because of the wetness and the high shrink-swell potential. Properly designing and strengthening footings and foundations can help to prevent structural damage. In low areas suitable fill material may be needed to raise the existing level of the site. Waterproofing walls and installing an artificial drainage system help to protect basements.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Kent soil is 8C, and that assigned to the Selkirk soil is 2C. The Michigan soil management group assigned to the Kent soil is 1a, and that assigned to the Selkirk soil is 1b.

86C—Nester-Graycalm complex, 6 to 12 percent slopes. These gently rolling soils are on knolls and ridges in the uplands. The Nester soil is well drained, and the Graycalm soil is somewhat excessively drained.

Individual areas are irregular in shape and range from 10 to 80 acres in size. They are about 40 to 60 percent Nester soil and 30 to 50 percent Graycalm soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion. In some areas the substratum is gravelly or sandy.

Typically, the Graycalm soil has a surface layer of black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. In some areas the bands do not occur. In other areas the combined thickness of the bands is more than 6 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin soils and the well drained Menominee and Montcalm soils. Kawkawlin soils are lower on the landscape than the Nester soil. Menominee and Montcalm soils are in landscape positions similar to those of the Nester and Graycalm soils. Menominee soils have sandy layers in the upper part and have a loamy substratum. Montcalm soils have a subsoil that is dominantly loamy sand but that has a thick layer of sandy loam. Included soils make up 10 to 20 percent of the unit.

Permeability is slow in the Nester soil and rapid in the Graycalm soil. Available water capacity is high in the Nester soil and low in the Graycalm soil. Runoff is medium on the Nester soil and slow on the Graycalm soil.

Most areas of these soils are wooded. A few areas are used as cropland or pasture.

These soils are moderately well suited to corn, small grain, and alfalfa hay. The major management concerns are water erosion, soil blowing, droughtiness, tilth, and the organic matter content. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during periods of heavy rainfall. A cropping system that includes close-growing crops helps to control water erosion and soil blowing.

Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, such as rye, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Minimizing tillage or tilling the soils at the proper moisture content helps to prevent cloddiness and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, help to maintain tilth.

These soils are well suited to pasture. The management concerns are surface compaction and droughtiness. During the summer months, when the Graycalm soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover and increase the susceptibility to soil blowing. The Nester soil is subject to compaction if the pasture is grazed during wet periods. Proper stocking rates, rotation or strip grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

Where these soils are used as woodland, the major management concerns are the equipment limitation, seedling mortality, and plant competition. On the Nester soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Loose sand in heavily traveled areas of the Graycalm soil can interfere with the traction of wheeled equipment, especially during dry periods. Year-round logging roads should be graveled. The loss of tree seedlings on the Graycalm soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are moderately well suited to building site development. Some land grading may be needed because of the slope. The moderate shrink-swell potential of the Nester soil is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Nester soil is 3L, and that assigned to the Graycalm soil is 6S. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Graycalm soil is 5a.

86D—Nester-Graycalm complex, 12 to 18 percent slopes. These rolling soils are on knolls and ridges in

the uplands. The Nester soil is well drained, and the Graycalm soil is somewhat excessively drained. Individual areas are irregular in shape and range from 10 to 80 acres in size. They are about 40 to 60 percent Nester soil and 30 to 50 percent Graycalm soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 23 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In some places the subsoil has more clay. In other places the mixed upper part of the subsoil does not occur or has been destroyed by plowing or erosion. In some areas the substratum is gravelly or sandy.

Typically, the Graycalm soil has a surface layer of black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. In some areas the bands do not occur. In other areas they have a combined thickness of more than 6 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin soils and the well drained Menominee and Montcalm soils. Kawkawlin soils are lower on the landscape than the Nester soil. Menominee and Montcalm soils are in landscape positions similar to those of the Nester and Graycalm soils. Menominee soils have sandy layers in the upper part and have a loamy substratum. Montcalm soils have a subsoil that is dominantly loamy sand but that has a thick layer of sandy loam. Included soils make up 10 to 20 percent of the unit.

Permeability is slow in the Nester soil and rapid in the Graycalm soil. Available water capacity is high in the Nester soil and low in the Graycalm soil. Runoff is rapid on the Nester soil and slow on the Graycalm soil.

Most areas of these soils are wooded. A few areas are used as cropland or pasture.

Because of the hazard of water erosion, these soils are poorly suited to use as cropland. Corn, small grain, and alfalfa hay, however, can be grown. Water erosion, soil blowing, droughtiness, tilth, and the organic matter content are management concerns. A system of conservation tillage that leaves all or part of the crop residue on the surface helps to control water erosion and soil blowing and helps to prevent crusting during

periods of heavy rainfall. A cropping system that includes close-growing crops helps to control water erosion and soil blowing. Grassed waterways, diversions, and erosion-control structures help to prevent gullyng. Cover crops, such as rye, buffer strips, vegetative barriers, and windbreaks help to control soil blowing. Minimizing tillage or tilling the soils at the proper moisture content helps to prevent clodding and compaction. Conservation tillage and additions of organic material, such as crop residue, green manure, and manure, help to maintain tilth.

These soils are moderately well suited to pasture. The management concerns are surface compaction, water erosion, and droughtiness. During the summer months, when the Graycalm soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Maintaining an adequate plant cover by preventing overgrazing helps to control runoff and water erosion. Overgrazing during dry periods can destroy the plant cover and increase the susceptibility to soil blowing. The Nester soil is subject to compaction if the pasture is grazed during wet periods. Proper stocking rates, rotation or strip grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The major management concerns in the areas used as woodland are the equipment limitation, seedling mortality, and plant competition. On the Nester soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Loose sand in heavily traveled areas of the Graycalm soil can interfere with the traction of wheeled equipment, especially during dry periods. Year-round logging roads should be graveled. The loss of tree seedlings on the Graycalm soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are moderately well suited to building site development. The slope is a limitation. The moderate shrink-swell potential of the Nester soil also is a limitation. Some land grading may be needed. Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

The land capability classification is IVe. The woodland ordination symbol assigned to the Nester soil

is 3L, and that assigned to the Graycalm soil is 6S. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Graycalm soil is 5a.

86E—Nester-Graycalm complex, 18 to 35 percent slopes. These hilly and steep soils are on knolls and ridges in the uplands. The Nester soil is well drained, and the Graycalm soil is somewhat excessively drained. Individual areas are irregular in shape and range from 10 to 80 acres in size. They are about 40 to 60 percent Nester soil and 30 to 50 percent Graycalm soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Nester soil has a surface layer of very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 27 inches thick. It is firm. The upper part is about 5 inches of mixed dark brown loam and brown fine sandy loam. The lower part is dark yellowish brown and yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In places the subsoil has more clay. In some areas the substratum is gravelly or sandy.

Typically, the Graycalm soil has a surface layer of black sand about 2 inches thick. The subsoil is about 74 inches thick. The upper part is strong brown, yellowish brown, and brownish yellow, friable sand. The lower part is light yellowish brown, loose sand with bands of strong brown, loose loamy sand $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. In some areas the bands do not occur. In other areas they have a combined thickness of more than 6 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Kawkawlin soils and the well drained Menominee and Montcalm soils. Kawkawlin soils are lower on the landscape than the Nester soil. Menominee and Montcalm soils are in landscape positions similar to those of the Nester and Graycalm soils. Menominee soils have sandy layers in the upper part and have a loamy substratum. Montcalm soils have a subsoil that is dominantly loamy sand but that has a thick layer of sandy loam. Included soils make up 10 to 20 percent of the unit.

Permeability is slow in the Nester soil and rapid in the Graycalm soil. Available water capacity is high in the Nester soil and low in the Graycalm soil. Runoff is rapid on the Nester soil and slow on the Graycalm soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. On the Nester soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soil is wet,

unsurfaced roads are slippery and ruts form easily. Loose sand in heavily traveled areas of the Graycalm soil can interfere with the traction of wheeled equipment, especially during dry periods. Year-round logging roads should be graveled. The use of equipment is restricted by the slope. Special care is needed in laying out roads and landings and in operating equipment. Because of the hazard of erosion, skid roads and logging roads should be established on the contour. Water should be removed with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging areas, and skid roads after the trees are logged helps to establish a protective plant cover.

The loss of tree seedlings on the Graycalm soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

These soils are poorly suited to building site development because of the slope. Some land grading may be needed. The moderate shrink-swell potential of the Nester soil is a limitation. Properly designing and strengthening footings and foundations can help to prevent structural damage.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Nester soil is 3R, and that assigned to the Graycalm soil is 6R. The Michigan soil management group assigned to the Nester soil is 1.5a, and that assigned to the Graycalm soil is 5a.

87C—Isabella-Melita complex, burned, 6 to 18 percent slopes. These gently rolling and rolling soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are about 60 to 80 percent Isabella soil and 20 to 40 percent Melita soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical. Repeated fires on these soils have disturbed the surface and have changed the tree species composition from maple and beech to northern oak.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark

brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Typically, the Melita soil has a surface layer of black and very dark grayish brown sand about 2 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, dark yellowish brown, yellowish brown, and light yellowish brown, loose sand. The lower part is friable, mixed yellowish brown clay loam and pale brown very fine sandy loam. In places the loamy material is within a depth of 40 inches.

Permeability is moderate in the Isabella soil. It is rapid in the upper part of the Melita soil and moderately slow in the lower part. Runoff is slow on both soils. Available water capacity is high in the Isabella soil and low in the Melita soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, plant competition, and seedling mortality. On the Isabella soil, the use of equipment is briefly limited in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Loose sand in heavily traveled areas of the Melita soil can interfere with the traction of wheeled equipment, especially during dry periods. The loss of tree seedlings on the Melita soil is caused by droughtiness. Planting containerized seedlings or special nursery stock can reduce the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is IVe. The woodland ordination symbol assigned to the Isabella soil is 6L, and that assigned to the Melita soil is 6S. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Melita soil is 5/2a.

87E—Isabella-Melita complex, burned, 18 to 40 percent slopes. These hilly to very steep soils are on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are about 60 to 80 percent Isabella soil and 20 to 40 percent Melita soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical. Repeated fires on these soils have disturbed the surface and have

changed the tree species composition from maple and beech to northern oak.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Typically, the Melita soil has a surface layer of black and very dark grayish brown sand about 2 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, dark yellowish brown, yellowish brown, and light yellowish brown, loose sand. The lower part is friable, mixed yellowish brown clay loam and pale brown very fine sandy loam. In places the loamy material is within a depth of 40 inches.

Permeability is moderate in the Isabella soil. It is rapid in the upper part of the Melita soil and moderately slow in the lower part. Runoff is medium on both soils. Available water capacity is high in the Isabella soil and low in the Melita soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. On the Isabella soil, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Loose sand in heavily traveled areas of the Melita soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be graveled. The use of equipment is restricted because of the slope. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Because of the hazard of erosion, skid roads and logging roads should be established on the contour. Water should be removed with water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging areas, and skid roads after the trees are logged helps to establish a protective plant cover.

The loss of tree seedlings on the Melita soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation

by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is VIIe. The woodland ordination symbol is 6R. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Melita soil is 5/2a.

90C—Rubicon-Montcalm complex, 6 to 18 percent slopes. These gently rolling and rolling soils are on knolls and ridges in the uplands. The Rubicon soil is excessively drained, and the Montcalm soil is well drained. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are about 60 to 85 percent Rubicon soil and 15 to 40 percent Montcalm soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Rubicon soil has a surface layer of black sand about 1 inch thick. The subsurface layer is grayish brown sand about 2 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, very friable sand. The lower part is dark yellowish brown and brownish yellow, loose sand. The substratum to a depth of about 60 inches is light yellowish brown and yellowish brown sand. In some places the substratum is mottled and gravelly. In other places the soil has a loamy substratum below a depth of 40 inches.

Typically, the Montcalm soil has a surface layer of dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Permeability is rapid in the Rubicon soil and moderately rapid in the Montcalm soil. Runoff is slow on both soils. Available water capacity is low in the Rubicon soil and moderate in the Montcalm soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be graveled. The loss of tree seedlings on the Rubicon soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality

rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is VII_s. The woodland ordination symbol assigned to the Rubicon soil is 4S, and that assigned to the Montcalm soil is 3A. The Michigan soil management group assigned to the Rubicon soil is 5.3a, and that assigned to the Montcalm soil is 4a.

93C—Klacking-Isabella complex, 6 to 12 percent slopes. These gently rolling, well drained soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 200 acres in size. They are about 50 to 70 percent Klacking soil and 30 to 50 percent Isabella soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Klacking soil has a surface layer of black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is friable, strong brown sandy loam and light yellowish brown sand. In some areas the bands have a combined thickness of less than 6 inches. In other areas the subsoil has more clay.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Permeability is moderately rapid in the Klacking soil and moderate in the Isabella soil. Runoff is slow on both soils. Available water capacity is low in the Klacking soil and high in the Isabella soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Klacking soil can interfere with the traction of wheeled equipment, especially during dry periods. On the Isabella soil, the use of equipment is briefly restricted in

spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. The loss of tree seedlings on the Klacking soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is III_e. The woodland ordination symbol assigned to the Klacking soil is 6S, and that assigned to the Isabella soil is 3L. The Michigan soil management group assigned to the Klacking soil is 4a, and that assigned to the Isabella soil is 2.5a.

93D—Klacking-Isabella complex, 12 to 18 percent slopes. These rolling, well drained soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 200 acres in size. They are about 50 to 70 percent Klacking soil and 30 to 50 percent Isabella soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Klacking soil has a surface layer of black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is friable, strong brown sandy loam and light yellowish brown sand. In some areas the bands have a combined thickness of less than 6 inches. In other areas the subsoil has more clay.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Permeability is moderately rapid in the Klacking soil and moderate in the Isabella soil. Runoff is slow on both soils. Available water capacity is low in the Klacking soil and high in the Isabella soil.

These soils are used as woodland. The major

concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Klacking soil can interfere with the traction of wheeled equipment, especially during dry periods. On the Isabella soil, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. The loss of tree seedlings on the Klacking soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is IVe. The woodland ordination symbol assigned to the Klacking soil is 6S, and that assigned to the Isabella soil is 3L. The Michigan soil management group assigned to the Klacking soil is 4a, and that assigned to the Isabella soil is 2.5a.

93E—Klacking-Isabella complex, 18 to 25 percent slopes. These hilly, well drained soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 200 acres in size. They are about 50 to 70 percent Klacking soil and 30 to 50 percent Isabella soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Klacking soil has a surface layer of black sand about 2 inches thick. The subsoil is about 80 inches thick. The upper part is yellowish brown and dark yellowish brown, friable sand; the next part is yellowish brown, friable sand with bands of strong brown loamy sand; and the lower part is friable, strong brown sandy loam and light yellowish brown sand. In some areas the bands have a combined thickness of less than 6 inches. In other areas the subsoil has more clay.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some

places the subsoil has more clay. In other places it has less clay.

Permeability is moderately rapid in the Klacking soil and moderate in the Isabella soil. Runoff is medium on both soils. Available water capacity is low in the Klacking soil and high in the Isabella soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, the hazard of erosion, seedling mortality, and plant competition. Loose sand in heavily traveled areas of the Klacking soil can interfere with the traction of wheeled equipment, especially during dry periods. On the Isabella soil, the use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. The use of equipment is restricted because of the slope. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover.

The loss of tree seedlings on the Klacking soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is VIe. The woodland ordination symbol assigned to the Klacking soil is 6R, and that assigned to the Isabella soil is 3R. The Michigan soil management group assigned to the Klacking soil is 4a, and that assigned to the Isabella soil is 2.5a.

94B—Isabella-Montcalm loamy sands, 0 to 6 percent slopes. These nearly level and undulating, well drained soils are on broad uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are 40 to 60 percent Isabella soil and 40 to 60 percent Montcalm soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Typically, the Montcalm soil has a surface layer of dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Permeability is moderate in the Isabella soil and moderately rapid in the Montcalm soil. Runoff is slow on both soils. Available water capacity is high in the Isabella soil and moderate in the Montcalm soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation and plant competition. The use of equipment is briefly restricted on the Isabella soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is IIe. The woodland ordination symbol assigned to the Isabella soil is 3L, and that assigned to the Montcalm soil is 3A. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Montcalm soil is 4a.

94C—Isabella-Montcalm loamy sands, 6 to 18 percent slopes. These gently rolling and rolling, well drained soils are on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are 40 to 60 percent Isabella soil and 40 to 60 percent Montcalm soil. The two soils occur as areas so intricately mixed or so small

that separating them in mapping is not practical.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Typically, the Montcalm soil has a surface layer of dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Permeability is moderate in the Isabella soil and moderately rapid in the Montcalm soil. Runoff is slow on both soils. Available water capacity is high in the Isabella soil and moderate in the Montcalm soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation and plant competition. The use of equipment is briefly restricted on the Isabella soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is IVe. The woodland ordination symbol assigned to the Isabella soil is 3L, and that assigned to the Montcalm soil is 3A. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Montcalm soil is 4a.

94E—Isabella-Montcalm loamy sands, 18 to 25 percent slopes. These hilly, well drained soils are on knolls and ridges in the uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are 40 to 60 percent Isabella soil and 40 to 60 percent Montcalm soil. The two soils occur as areas

so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Typically, the Montcalm soil has a surface layer of dark grayish brown loamy sand about 1 inch thick. The subsurface layer is brown loamy sand about 5 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is light yellowish brown, very friable loamy sand; strong brown, friable sandy clay loam; dark brown, friable sandy loam; and yellowish brown and brownish yellow, friable loamy sand with bands of dark yellowish brown and yellowish brown, friable sandy loam. In some places the subsoil has less clay. In other places the substratum is sand and gravel.

Permeability is moderate in the Isabella soil and moderately rapid in the Montcalm soil. Runoff is medium on both soils. Available water capacity is high in the Isabella soil and moderate in the Montcalm soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, the hazard of erosion, and plant competition. The use of equipment is briefly restricted on the Isabella soil in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled. The use of equipment is restricted because of the slope. Special care is needed in laying out logging roads and in operating equipment. The slope limits the number of suitable landing sites. Erosion results from the concentration of runoff on logging roads, in the tracks of wheeled equipment, and on landings. Removing water with water bars, out-sloping road surfaces, culverts, and drop structures helps to control erosion. Also, building the roads on the contour or on the gentler slopes helps to prevent excessive soil loss. Seeding logging areas and skid roads after the trees are logged helps to establish a protective plant cover. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is VIe. The woodland ordination symbol is 3R. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Montcalm soil is 4a.

97B—Isabella-Melita complex, 0 to 6 percent slopes. These nearly level and undulating soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are about 60 to 75 percent Isabella soil and 25 to 40 percent Melita soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places the subsoil has more clay. In other places it has less clay.

Typically, the Melita soil has a surface layer of black and very dark grayish brown sand about 2 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, dark yellowish brown, yellowish brown, and light yellowish brown, loose sand. The lower part is friable, mixed yellowish brown clay loam and pale brown very fine sandy loam. In some places the soil has a substratum of clay loam. In other places the loamy material is within a depth of 40 inches.

Permeability is moderate in the Isabella soil. It is rapid in the upper part of the Melita soil and moderately slow in the lower part. Runoff is slow on both soils. Available water capacity is high in the Isabella soil and low in the Melita soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. The use of equipment on the Isabella soil is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Loose sand in heavily traveled areas of the Melita soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be graveled. The loss of tree seedlings on the Melita soil is caused by droughtiness. Planting containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the

establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is IIe. The woodland ordination symbol assigned to the Isabella soil is 3L, and that assigned to the Melita soil is 3S. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Melita soil is 5/2a.

97C—Isabella-Melita complex, 6 to 18 percent slopes. These gently rolling and rolling soils are on knolls, ridges, and broad uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are about 60 to 75 percent Isabella soil and 25 to 40 percent Melita soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Isabella soil has a surface layer of brown loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 2 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is dark yellowish brown, very friable sandy loam; brown, firm sandy loam; mixed brown and dark brown, firm sandy loam and sandy clay loam; and dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown fine sandy loam. In some places it has more clay. In other places it has less clay.

Typically, the Melita soil has a surface layer of black and very dark grayish brown sand about 2 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, dark yellowish brown, yellowish brown, and light yellowish brown, loose sand. The lower part is friable, mixed yellowish brown clay loam and pale brown very fine sandy loam. In some places the soil has a substratum of clay loam. In other places the loamy material is within a depth of 40 inches.

Permeability is moderate in the Isabella soil. It is rapid in the upper part of the Melita soil and moderately slow in the lower part. Runoff is slow on both soils. Available water capacity is high in the Isabella soil and low in the Melita soil.

These soils are used as woodland. The major concerns in managing woodland are the equipment limitation, seedling mortality, and plant competition. The use of equipment on the Isabella soil is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Loose sand in heavily traveled areas of the Melita soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be graveled. The loss of tree seedlings on the Melita soil is caused by droughtiness. Planting

containerized seedlings or special nursery stock reduces the seedling mortality rate. Undesirable plants that invade clearcut areas can delay or prevent the establishment of desirable species. If trees are planted, site preparation by mechanical or chemical means is needed to control the competing vegetation.

The land capability classification is IVe. The woodland ordination symbol assigned to the Isabella soil is 3L, and that assigned to the Melita soil is 3S. The Michigan soil management group assigned to the Isabella soil is 2.5a, and that assigned to the Melita soil is 5/2a.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to

other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use

and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties (9).

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained (11); and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1984, about 47,000 acres in Ogemaw County was used as cropland (5). Of this, about 9,400 acres was planted to corn, 5,200 acres to oats, 1,700 acres to wheat, 600 acres to barley, and 380 acres to soybeans. A number of specialty crops and truck crops were also grown. The acreage is relatively small, and the produce is sold locally.

Food production in Ogemaw County could be increased by applying proper soil and water conservation practices and by applying the latest crop production technology to all cropland in the county. This soil survey can help to determine the conservation practices needed.

Crops on most of the agricultural soils in the county respond well to applications of nitrogen, phosphorus, and potassium fertilizers. Many of the soils may require periodic applications of ground limestone for alfalfa and other crops that grow well only in slightly acid or neutral soils. The amount of lime and fertilizer used should be based on the results of soil tests, on the needs of the crop grown, and on the expected level of yields (6). The Cooperative Extension Service can help to determine the proper amounts of fertilizer and lime to be applied.

Organic matter is an important source of nitrogen for

crops. It also promotes good soil tilth, minimizes surface crusting, increases the available water capacity and rate of water infiltration, and reduces the hazard of water erosion. Increasing or maintaining the organic matter content is a management concern on most of the well drained and somewhat poorly drained soils that are used as cropland. The organic matter content can be maintained or increased by using a cropping system that includes grasses and legumes, returning crop residue to the soil, and regularly adding other organic material.

Maintaining good soil tilth is a management concern on the somewhat poorly drained Selkirk and Kawkawlin soils and on the poorly drained Pickford, Sims, and Angelica soils. It is also a concern on the eroded phases of the well drained Kent and Nester soils. Working these soils when they are too wet results in compaction and the formation of clods. Additional tillage to break up surface clods causes further compaction of the lower part of the surface layer and the subsoil. Compaction inhibits root development, reduces crop yields, and thus reduces the organic matter content of the soils. Compaction and the loss of organic matter increase the severity of surface crusting. Surface crusting hinders seedling emergence and increases the runoff rate and the susceptibility to erosion. Leaving all or part of the crop residue on the surface, planting cover crops, and adding organic matter help to maintain good tilth.

Conserving soil moisture during dry periods is a management concern on the Au Gres, Croswell, Gladwin, Graycalm, Klacking, Mancelona, Manistee, and Menominee soils. Conservation tillage helps to conserve soil moisture by increasing the organic matter content and thus also increasing the available water capacity, increasing the rate of water infiltration, and reducing the evaporation rate.

Water erosion is a major hazard on the well drained soils used as cropland in the county. Erosion reduces the productive capacity of the soils by removing the surface layer, which contains most of the available plant nutrients and organic matter. Controlling water erosion is a management concern on the soils that have slopes of 4 percent or more. It is also a concern in undulating areas of the Nester, Kawkawlin, Kent, Selkirk, Isabella, and Alcona soils.

Erosion-control practices provide a protective surface cover, reduce the runoff rate, and increase the infiltration rate. A cropping system that keeps a plant cover on the soil for an extended period reduces the

hazard of erosion and preserves the productivity of the soils. Including legumes and grasses in a cropping system reduces the hazard of erosion in sloping areas, provides nitrogen for other crops, and improves soil tilth. Conservation tillage helps to control surface runoff and erosion. Cover crops, crop residue management, and grassed waterways also help to prevent excessive erosion. Contour farming or contour strip cropping can control erosion on long slopes, but these practices generally cannot be readily applied to the short, steep slopes in the county.

Soil blowing is a management concern on most of the soils in Ogemaw County if the surface is unprotected. Maintaining a plant cover, using surface mulch, planting vegetative barriers and field windbreaks, and roughening the surface by tillage minimize soil blowing. Conservation tillage also helps to prevent excessive soil blowing.

Some soils are naturally too wet to be used as cropland or pasture unless they are artificially drained. These are the poorly drained Roscommon, Sims, Pickford, Angelica, Tonkey, Wheatley, Epoufette, and Brevort soils. The somewhat poorly drained Au Gres, Kawkawlin, Selkirk, Ingalls, Allendale, Belding, and Iosco soils also require artificial drainage for optimum crop yields.

The proper design of surface and subsurface drainage systems varies according to the kind of soil in which they are used. A combination of surface and subsurface drains is needed in most areas of the somewhat poorly drained and poorly drained soils that are intensively row cropped. Finding adequate outlets for drainage systems is difficult in some areas.

Much of the permanent pasture in the county is in areas of soils that are susceptible to erosion and in areas of wet soils. Control of erosion is particularly important when the pasture is seeded. The need for lime and fertilizer should be determined by soil tests. Adequate amounts should be applied.

Soil compaction, caused by grazing when the soils are moist, retards the growth of pasture plants. Using proper harvesting methods for such crops as hay and silage increases the growth rate and minimizes compaction.

The productivity of pasture and its ability to protect the surface of the soil is influenced by the number of livestock it supports, the length of grazing time, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the key forage species, rotation grazing, timely deferment of grazing,

and strategically located livestock water.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (11). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely

major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability

classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Also given at the end of each map unit description is a Michigan soil management group. The soils are assigned to a group according to the dominant profile texture, the natural drainage class, and the major management concerns. For soils making up a complex, the management groups are listed in the same order as the series named in the complex (7).

Woodland Management and Productivity

Ogemaw County originally was covered with virgin forests of pine and hardwoods. The entire area was logged and slash burned. Many areas were cleared. Most of the present woodland supports second-growth timber, and much of the cleared land has been replanted to pine. The present woodland stands are smaller than the original stands but are still an important and valuable resource in the county.

About 243,000 acres, or about 66 percent, of Ogemaw County is woodland. About 76,000 acres is state forests, and 20,000 acres is national forests. Several private companies have large tracts of woodland, but small, individually owned areas make up nearly 147,000 acres of woodland.

Forest Cover Types

Five major types of forest cover are within the county (8). Each is distinctly different. Each has different value and potential for forest use and for the production of woodland products. Generally, the soils under the different types of forest cover also differ.

Jack pine forest cover type.—Jack pine and northern pin oak are the dominant species in this cover type. Other common associated trees are eastern white pine, red pine, and bigtooth aspen. This cover type is mainly on the nearly level Graycalm and Grayling soils. These soils are deep and sandy and have weak profile development. The more droughty and less fertile soils support only northern pin oak and jack pine. Tree growth is slow, and reestablishing trees in cutover areas is difficult.

Oak-red maple forest cover type.—Northern red oak and red maple are the dominant species in this cover type. Other associated trees include bigtooth aspen, red pine, eastern white pine, and paper birch. The original virgin forest cover was mainly eastern white pine, which was almost completely removed by logging. Today, white pine makes up only a small part of the forest cover. Red maple distinguishes this cover type from transitional areas of the jack pine cover type. The oak-

red maple cover type is mainly on the Rubicon, Montcalm, Klacking, and Graycalm soils. These soils are deep and sandy. The Montcalm, Klacking, and Graycalm soils have loamy or sandy bands in the subsoil. Tree growth is good on these soils. Young plantations of red pine and eastern white pine are common in areas of this cover type.

Sugar maple-beech-yellow birch forest cover type.—Sugar maple is the most common species in this cover type and is almost always dominant. American beech, yellow birch, and red maple, however, are also common. Other common associated trees are black cherry, northern red oak, and quaking aspen. Also included are varying numbers of American basswood and white ash. The virgin forest of this cover type consisted of northern hardwoods. The soils that support this cover type are those of the Isabella, Manistee, Menominee, Montcalm, and Nester series, which are loamy soils and the more fertile sandy soils. These soils are the most productive in the survey area. Tree growth is good or excellent, and the potential for wood products is high. The acreage of the cover type is relatively small, however, because these soils are used mainly for more intensive farming.

Red maple-paper birch-white spruce-balsam fir forest cover type.—Most stands of this cover type are a mixture of wetland hardwoods and conifers. Red maple, paper birch, quaking aspen, white spruce, balsam fir, and eastern hemlock are dominant. Other common associated trees are eastern white pine, northern whitecedar, black ash, and balsam poplar. Also included are varying numbers of sugar maple and northern red oak. American elm was an important component of this cover type, but most of these trees have been killed by Dutch elm disease. In many areas much of the dead wood has been removed for use as firewood. This cover type is on sandy and loamy soils that have a seasonal high water table. The soils are those of the Au Gres, Croswell, Iosco, Allendale, Ingalls, and Kawkawlin series. Tree growth is fair to good on these soils.

Northern whitecedar forest cover type.—Northern whitecedar is dominant in this cover type, but other common associated trees are black spruce, black ash, red maple, eastern hemlock, balsam fir, balsam poplar, and tamarack. This cover type is on the Lupton, Roscommon, Tawas, and Cathro soils. These are poorly drained and very poorly drained, organic soils and sandy soils. The water table is at or near the surface most of the time. Tree growth is slow. Reestablishing stands of desirable trees in cutover areas is difficult. The hazard of windthrow is a serious

concern in areas that are opened up by cutting.

Woodland Products

The number of trees harvested for woodland products each year is steadily increasing in the county. High production can continue if the woodland is properly managed. The more important woodland products in the county are described in the following paragraphs.

Pulpwood.—Most of the pulpwood is taken from cuttings in small tracts of state-administered land or from land owned by paper companies. Aspen and jack pine are the most common trees cut for pulp. Some spruce, balsam fir, and hemlock are also cut. The county has the potential for producing a large amount of pulpwood. Most of the privately owned woodland tracts are too small for logging operations. Owners of several adjoining tracts, however, could combine their logging operations.

Lumber.—An increasing amount of timber is being harvested for sawlogs in the county. The trees in most wooded areas are relatively young; most are pole or sapling size. Most of the large, high-quality trees have been removed, and most of the remaining larger trees are of poor quality and cannot be used for lumber. Only a few areas support many high-quality trees of sawlog size. Northern hardwood stands generally should be culled or thinned, or both. Most pine plantations should be thinned. Northern red oak, sugar maple, and red pine are cut mainly for lumber. Aspen is cut for pallet material.

Firewood.—Many homes use firewood as either the main source or a supplementary source of heat. Wood chips are a good fuel. The entire tree can be used for this purpose. Oak and maple are most commonly used as firewood, but most trees have some value for this use.

Poles and posts.—The numerous red pine and jack pine plantations that should be thinned are a good potential source of treated poles and posts. Northern whitecedar in some of the wet areas is also a potential source of posts.

Maple syrup.—Northern hardwood stands that include mature sugar maple trees have good potential for the production of maple syrup.

Woodland recreation.—The extensive woodland in the county, particularly the large amount on public lands, provides recreation opportunities throughout the year.

The Soil Conservation Service, the Michigan Department of Natural Resources, the Cooperative Extension Service, and consultant foresters can help to

determine woodland management needs.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength in the spring thaw period and during periods of high rainfall. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *R*, *X*, *W*, *T*, *D*, *C*, *S*, *F*, and *L*.

In table 8, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil

wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to very firm soil layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the

amount of fiber produced in a fully stocked, even-aged, unmanaged stand. The volume was determined through the use of standard yield tables (13).

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production (fig. 9).

Table 9 gives information about operating harvesting or thinning equipment in logging areas and on skid trails, landings, and logging roads. Limitations are given for the most limiting season and for the preferred season. The *most limiting season* in Ogemaw County generally is spring or late fall. In some areas, however, it is during dry periods in summer, when loose sand can limit trafficability on deep, well drained, sandy soils. The *preferred operating season* is the period when harvesting or thinning causes the least amount of soil damage. This period generally is when the soil is not too wet or when the ground is frozen or partly frozen or has an adequate snow cover.

In table 9, a rating of *slight* indicates that the use of conventional logging equipment is not restricted if normal logging methods are used. A rating of *moderate* indicates that the use of equipment is restricted because of one or more soil factors. If wetness is a limitation, high flotation equipment or special procedures may be needed to prevent the formation of ruts. A rating of *severe* indicates that the kind of equipment that can be used is seriously restricted.

Logging areas and skid roads include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid roads, which generally are within the logging area, are roads or trails over which logs are dragged or hauled from the stump to a log landing.

Log landings are areas where logs are assembled for transportation. Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging.

Haul roads are access roads leading from primary or surfaced roads to the logging areas. The logging roads serve as transportation routes for wheeled logging equipment and logging trucks. Generally, they are unpaved roads. Some are graveled.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several



Figure 9.—Red pine planted on Mancelona sand, 0 to 6 percent slopes.

rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings

that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Recreation is a major land use in Ogemaw County. Most of the land in the county is used for nonintensive recreational purposes, such as fishing, hunting, canoeing, camping, hiking, and sightseeing. Winter activities include cross-country skiing and snowmobiling. Many areas are developed for intensive recreational uses, such as parks, campgrounds, and picnic areas. Because of an expanding population and increasing

amounts of leisure time, land use is certain to undergo changes in the future. More land probably will be converted to various types of recreational areas.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding

during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Ogemaw County has a variety of wildlife. The principal kinds are white-tailed deer, black bear, gray and fox squirrels, cottontail rabbits, snowshoe hares, bobcats, wild turkeys, ruffed grouse, and various other birds. The northwestern part of the county is managed for Kirtland's warbler nesting habitat.

Many lakes and streams in the county provide good fishing for trout, northern pike, largemouth bass, walleye, and a variety of other game fish.

Habitat for wildlife in the county ranges from farmland to northern hardwood climax forests. Much of the habitat can be improved by establishing more water areas and by increasing the extent of vegetation that provides food and cover.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or

very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, brome grass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, wild carrot, dandelion, lambsquarters, and strawberry.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, aspen, cherry, apple, hawthorn, dogwood, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils

rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattails, arrowhead, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, red fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas (fig. 10). Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development,



Figure 10.—Histosols and Aquents, ponded, provide excellent habitat for wetland wildlife.

Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were

not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the

potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction

costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer

should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may

have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil. Excessive slope can affect the storage capacity of the reservoir area.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table and permeability of the

aquifer. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to firm layers or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to a firm layer, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone and by soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 11). "Loam," for example, is soil that is

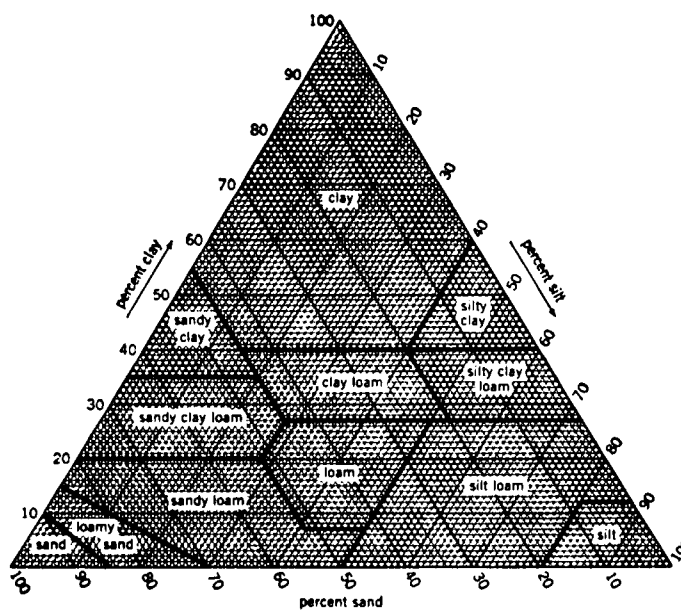


Figure 11.—Percentage of clay, silt, and sand in the basic USDA soil textural classes.

7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and

highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations

and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $\frac{1}{3}$ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and

is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops.

They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

- 4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 19 shows the expected total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of

segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Soil Characterization Data for Selected Soils

Many of the soils in Ogemaw County were sampled for physical and chemical analyses by the Soil Research Laboratory, Ford Forestry Center, Michigan Technological University, L'Anse, Michigan. The laboratory data obtained from the soil samples included analyses of particle-size distribution, coarse fragments, bulk density, and moisture retention. Complete chemical analyses were also performed on each sample, and spodic horizon criteria were determined on the appropriate samples. Standard National Cooperative Soil Survey procedures were used for all analyses. Forested sites also were sampled for an estimate of the productivity of many of the sampled soils for wood products.

These data were used in classifying and correlating the soils and in evaluating their behavior, especially under forestry uses. A total of 12 profiles were selected as representatives of their series. These series and their laboratory identification numbers are as follows: Graycalm (S84MI-129-006), an Isabella taxadjunct (S84MI-129-003), Isabella (S85MI-129-005), Kent (S84MI-129-002), Kent (S84MI-129-003), Klacking (S84MI-129-004), a Mancelona taxadjunct (S84MI-129-005), a Klacking taxadjunct (S84MI-129-007), a Manistee taxadjunct (S84MI-129-004), a Montcalm taxadjunct (S84MI-129-002), Rubicon (S84MI-129-001), and Selkirk (S85MI-129-007).

In addition to the Ogemaw County data, soil characterization data and forest site data are available from nearby counties that have many of the same soils as Ogemaw County. These data and the Ogemaw County data are available from the Soil Research Laboratory, the Soil and Water Conservation Division of the Michigan Department of Agriculture, and the Soil Conservation Service.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (12). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthod (*Orth*, meaning true, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplorthods (*Hapl*, meaning minimal horizonation, plus *orthod*, the suborder of the Spodosols that has a horizon characterized by an accumulation of aluminum, iron, and organic carbon in which no one element dominates).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives

preceding the name of the great group. The adjective *Alfic* identifies a subgroup of the Haplorthods that contains an argillic horizon. An example is Alfic Haplorthods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, frigid Alfic Haplorthods.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (10). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (12). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alcona Series

The Alcona series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in stratified sandy and loamy glaciofluvial deposits. Slope ranges from 2 to 6 percent.

These soils do not have the dark brown layer in the upper part of the subsoil that is definitive for the Alcona series. Also, the lower part of the subsoil is finer textured than is defined as the range for the series. These differences, however, do not affect the usefulness or behavior of the soils.

Typical pedon of Alcona loamy fine sand, 2 to 6 percent slopes, 120 feet west and 800 feet south of the center of sec. 30, T. 22 N., R. 3 E., Churchill Township:

- Ap—0 to 9 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.
- E—9 to 12 inches; pale brown (10YR 6/3) very fine sandy loam; weak medium subangular blocky structure; friable; strongly acid; clear wavy boundary.
- B/E1—12 to 25 inches; dark yellowish brown (10YR 4/6) (Bt) and pale brown (10YR 6/3) (E) very fine sandy loam; moderate medium subangular blocky structure; friable; medium acid; clear wavy boundary.
- B/E2—25 to 42 inches; yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6), stratified loamy very fine sand and loamy fine sand; weak coarse subangular blocky structure; very friable; medium acid; abrupt smooth boundary.
- Bt—42 to 48 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; neutral; abrupt smooth boundary.
- C—48 to 60 inches; yellowish brown (10YR 5/4), stratified silt loam and loamy very fine sand; massive; firm; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 28 to 60 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes sandy loam. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 or 3. It is very fine sandy loam, loam, fine sand, loamy very fine sand, or sandy loam. The B part of the E/B and B/E horizons has hue of 7.5YR or 10YR, value of 3 or 4, and chroma

of 4 to 6. It is very fine sandy loam, loamy very fine sand, or loamy fine sand. The E part of these horizons has hue, value, chroma, and texture similar to those of the E horizon. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 3 or 4. It is silty clay loam or sandy clay loam. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 to 4. It is silt loam, loamy very fine sand, very fine sandy loam, or fine sandy loam.

Allendale Series

The Allendale series consists of somewhat poorly drained soils on outwash plains. These soils formed in sandy material overlying clayey deposits. Permeability is rapid in the upper part of the profile and slow in the lower part. Slope ranges from 0 to 4 percent.

Typical pedon of Allendale loamy sand, 0 to 4 percent slopes, 40 feet south and 1,100 feet east of the northwest corner of sec. 31, T. 23 N., R. 4 E., Hill Township:

- A—0 to 5 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; moderate fine granular structure; very friable; neutral; clear smooth boundary.
- E—5 to 8 inches; light gray (10YR 6/1) sand; single grain; loose; medium acid; clear smooth boundary.
- Bs—8 to 20 inches; yellowish brown (10YR 5/6) loamy sand; few fine distinct strong brown (7.5YR 5/8) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium granular structure; friable; neutral; abrupt smooth boundary.
- 2B/E—20 to 23 inches; brown (10YR 5/3) clay loam (Bt) and light brownish gray (10YR 6/2) sandy loam (E); common medium distinct yellowish brown (10YR 5/6) and few fine prominent very dark gray (10YR 3/1) mottles; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.
- 2Btg—23 to 29 inches; dark grayish brown (10YR 4/2) clay; few fine prominent greenish gray (5GY 6/1) and few fine faint very dark gray (10YR 3/1) mottles; about 5 percent gravel; strong medium subangular blocky structure; firm; neutral; clear wavy boundary.
- 2Cg—29 to 60 inches; weak red (2.5YR 5/2) silty clay; common medium prominent light gray (10YR 7/1), few medium distinct reddish brown (2.5YR 4/4), and common fine prominent yellowish red (5YR 5/6) mottles; massive; firm; moderately alkaline.

The thickness of the sandy layers ranges from 20 to

36 inches. The solum ranges from very strongly acid to neutral. The content of gravel ranges from 0 to 5 percent in the solum.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. It is dominantly loamy sand, but the range includes loamy fine sand. The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2. It is sand or fine sand. The Bs horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is sand or loamy sand. The E part of the 2B/E horizon has value of 5 to 7 and chroma of 2 or 3. The B part and the 2Bt horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The 2Bt horizon is silty clay or clay. The 2Cg horizon has hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay or clay.

Angelica Series

The Angelica series consists of poorly drained, moderately slowly permeable soils on ground moraines. These soils formed in loamy glacial deposits. Slope is 0 to 2 percent.

Typical pedon of Angelica loam, 70 feet east and 900 feet north of the southwest corner of sec. 35, T. 21 N., R. 1 E., Edwards Township:

- Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; about 2 percent gravel; neutral; abrupt wavy boundary.
- Bg—5 to 9 inches; dark grayish brown (10YR 4/2) clay loam; common medium distinct dark yellowish brown (10YR 4/6) and common medium prominent dark reddish brown (5YR 3/4) mottles; moderate medium subangular blocky structure; firm; about 2 percent gravel; mildly alkaline; clear wavy boundary.
- Bw—9 to 13 inches; dark brown (7.5YR 4/4) clay loam; common medium prominent greenish gray (5GY 5/1) and common medium distinct dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; about 3 percent gravel; mildly alkaline; clear wavy boundary.
- C1—13 to 40 inches; brown (7.5YR 5/4) loam; common medium prominent greenish gray (5GY 6/1) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 3 percent gravel; slightly effervescent; mildly alkaline; clear wavy boundary.
- C2—40 to 60 inches; light brown (7.5YR 6/4) loam; many medium prominent light gray (5Y 6/1) and

many medium distinct grayish brown (10YR 5/2) mottles; massive; firm; about 3 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 12 to 25 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam and mucky sandy loam. The Bg horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. It is clay loam or loam. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is clay loam, loam, or sandy clay loam. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. It is loam or silt loam.

Arnheim Series

The Arnheim series consists of poorly drained, moderately permeable soils on flood plains. These soils formed in stratified alluvium. Slope is 0 to 2 percent.

These soils have a thicker, darker surface layer than is definitive for the Arnheim series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Arnheim silt loam, 1,188 feet west and 924 feet south of the northeast corner of sec. 7, T. 23 N., R. 3 E., Cummings Township:

- A—0 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine and medium roots; slightly effervescent; moderately alkaline; clear wavy boundary.
- Cg1—13 to 33 inches; dark gray (10YR 4/1) silt loam; common medium prominent yellowish brown (10YR 5/6) and few medium faint gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; abrupt wavy boundary.
- 2Cg2—33 to 41 inches; dark grayish brown (10YR 4/2) sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; strongly effervescent; moderately alkaline; abrupt wavy boundary.
- 3Cg3—41 to 60 inches; dark gray (5Y 4/1) and very dark grayish brown (10YR 3/2), stratified silt loam and muck; massive; friable; mildly alkaline.

The A horizon has hue of 10YR or 7.5YR, value of 2

or 3, and chroma of 0 to 3. It is dominantly silt loam, but the range includes mucky loam and loam. The Cg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly silt loam, fine sandy loam, or loam that has occasional strata of sand, muck, or silty clay loam.

Au Gres Series

The Au Gres series consists of somewhat poorly drained, rapidly permeable soils on outwash plains and ground moraines. These soils formed in sandy glacial deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Au Gres sand, 0 to 3 percent slopes, 1,800 feet east and 1,800 feet north of the southwest corner of sec. 30, T. 23 N., R. 1 E., Foster Township:

- A—0 to 5 inches; black (10YR 2/1) sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and medium roots; slightly acid; abrupt wavy boundary.
- E—5 to 8 inches; pale brown (10YR 6/3) sand; common medium faint light gray (10YR 7/2) mottles; weak fine granular structure; very friable; many fine and medium roots; slightly acid; clear wavy boundary.
- Bs1—8 to 21 inches; strong brown (7.5YR 4/6) sand; weak fine granular structure; very friable; common fine and medium roots; slightly acid; clear wavy boundary.
- Bs2—21 to 31 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; neutral; clear wavy boundary.
- C—31 to 50 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; neutral; clear wavy boundary.
- Cg—50 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; neutral.

The thickness of the solum ranges from 23 to 48 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 3. The Bs horizon has hue of 5YR to 10YR and value and chroma of 3 to 6. The C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 8.

Belding Series

The Belding series consists of somewhat poorly

drained soils on till plains and lake plains. These soils formed in loamy glacial deposits. Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 3 percent.

These soils do not have the clay-enriched horizon in the lower part of the subsoil that is definitive for the Belding series. This difference, however, does not alter the usefulness or behavior of the soil.

Typical pedon of Belding sandy loam, 0 to 3 percent slopes, 100 feet west and 1,200 feet north of the southeast corner of sec. 18, T. 21 N., R. 1 E., Edwards Township:

- A1—0 to 3 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; many fine and common medium roots; neutral; clear wavy boundary.
- A2—3 to 12 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; many fine and common medium roots; neutral; abrupt wavy boundary.
- Bs1—12 to 20 inches; dark brown (7.5YR 4/4) sandy loam; few fine distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; very dark gray (10YR 3/1) organic stains along root channels; about 2 percent gravel; common medium roots; mildly alkaline; abrupt wavy boundary.
- Bs2—20 to 26 inches; brown (10YR 4/3) sandy loam; common fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; about 10 percent gravel; few fine roots; mildly alkaline; abrupt wavy boundary.
- 2Cg—26 to 60 inches; dark grayish brown (10YR 4/2) loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes fine sandy loam and loam. The Bs horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam or fine sandy loam. The 2C horizon has value of 4 to 6 and chroma of 1 or 2. It is clay loam, loam, or silty clay loam.

Brevort Series

The Brevort series consists of poorly drained soils on lake plains and ground moraines. These soils formed in sandy deposits underlain by silty or loamy glacial till. Permeability is moderately rapid or rapid in the upper part of the profile and moderately slow in the lower part. Slope is 0 to 2 percent.

These soils have a thinner surface layer and brighter colors in the upper part of the C horizon than is definitive for the Brevort series. These differences, however, do not affect the usefulness or behavior of the soils.

Typical pedon of Brevort mucky loamy sand, 1,000 feet north and 1,600 feet east of the southwest corner of sec. 28, T. 21 N., R. 3 E., Mills Township:

- A—0 to 5 inches; black (10YR 2/1) mucky loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine and medium roots; slightly acid; clear wavy boundary.
- C1—5 to 13 inches; brown (10YR 5/3) sand; few medium distinct gray (10YR 5/1) and few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; common fine and few medium roots; about 5 percent gravel; neutral; gradual wavy boundary.
- C2—13 to 19 inches; light yellowish brown (10YR 6/4) sand; common medium distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; single grain; loose; few fine roots; about 3 percent gravel; neutral; gradual wavy boundary.
- C3—19 to 23 inches; yellowish brown (10YR 5/4) sand; common fine prominent brown (7.5YR 5/2) and yellowish brown (10YR 5/6) mottles; single grain; loose; about 10 percent gravel; neutral; abrupt wavy boundary.
- Cg1—23 to 27 inches; light brownish gray (10YR 6/2) sand; few fine distinct brownish yellow (10YR 6/6) mottles; single grain; loose; about 14 percent gravel; mildly alkaline; abrupt wavy boundary.
- 2Cg2—27 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent greenish gray (5BG 6/1) and light olive brown (2.5Y 5/6) mottles; massive; firm; strongly effervescent; moderately alkaline.

The thickness of the sandy material and the depth to carbonates range from 20 to 40 inches. The content of gravel ranges from 0 to 5 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly mucky loamy sand, but the range

includes sand and loamy sand. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. It is sand, loamy fine sand, or loamy sand. The 2C horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 1 to 6. It is silty clay loam, silt loam, or clay loam.

Cathro Series

The Cathro series consists of very poorly drained soils in depressions on outwash plains and lake plains. These soils formed in woody organic material overlying loamy deposits. Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the loamy material. Slope is 0 to 2 percent.

Typical pedon of Cathro muck, 2,500 feet north and 75 feet east of the southwest corner of sec. 33, T. 24 N., R. 4 E., Goodar Township:

- Oa1—0 to 5 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 35 percent fibers, 15 percent rubbed; primarily woody material; weak fine granular structure; friable; slightly acid; clear smooth boundary.
- Oa2—5 to 19 inches; black (5YR 2/1), broken face and rubbed, sapric material; about 35 percent fibers, 10 percent rubbed; weak fine granular structure; friable; slightly acid; clear wavy boundary.
- Oa3—19 to 30 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 30 percent fibers, 10 percent rubbed; weak medium granular structure; friable; neutral; clear wavy boundary.
- Cg—30 to 60 inches; dark gray (10YR 4/1) sandy loam; massive; slightly sticky; neutral.

The depth to the C horizon ranges from 16 to 51 inches. The sapric material has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. Thin layers of woody fibers occur in the organic material in some pedons.

The surface tier is typically sapric material, but the range includes hemic material. The subsurface and bottom tiers are dominantly sapric material, but layers of hemic material are in some pedons. The C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 to 3. It is sandy loam, sandy clay loam, silty clay loam, or loam.

Colonville Series

The Colonville series consists of somewhat poorly

drained, moderately rapidly and rapidly permeable soils on flood plains. These soils formed in stratified alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Colonville silt loam, 0 to 3 percent slopes, 2,100 feet south and 400 feet east of the northwest corner of sec. 21, T. 21 N., R. 3 E., Mills Township:

- A—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium granular structure; friable; many fine and medium roots; slightly effervescent; mildly alkaline; clear wavy boundary.
- C1—11 to 22 inches; brown (10YR 4/3), stratified loamy sand, fine sandy loam, and sandy loam; few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; very friable; many fine and medium roots; slightly effervescent; moderately alkaline; abrupt wavy boundary.
- C2—22 to 44 inches; dark brown (10YR 3/3) sandy loam; many coarse prominent strong brown (7.5YR 4/6) and dark reddish brown (5YR 3/4) mottles; moderate medium subangular blocky structure; friable; very dark grayish brown (10YR 3/2) organic stains; common fine and few medium roots; slightly effervescent; moderately alkaline; abrupt wavy boundary.
- Cg—44 to 60 inches; gray (10YR 5/1) fine sand; many coarse prominent yellowish red (5YR 5/8) and strong brown (7.5YR 4/6) mottles; single grain; loose; very dark gray (10YR 3/1) organic stains; many very dark gray (5YR 3/1) woody fragments; strongly effervescent; mildly alkaline.

The content of gravel ranges from 0 to 5 percent in the C horizon. The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but the range includes fine sandy loam, sandy loam, and loamy fine sand. The C horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 1 to 6. It is fine sandy loam, sandy loam, loamy fine sand, loamy sand, fine sand, or sand.

Croswell Series

The Croswell series consists of moderately well drained, rapidly permeable soils on outwash plains and ground moraines. These soils formed in sandy glacial deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Croswell sand, 0 to 4 percent slopes, 1,700 feet east and 1,750 feet north of the

southwest corner of sec. 30, T. 23 N., R. 1 E., Foster Township:

- AE—0 to 7 inches; dark grayish brown (10YR 4/2) sand, gray (10YR 5/1) dry; single grain; loose; many fine and common medium roots; very strongly acid; abrupt wavy boundary.
- E—7 to 11 inches; pinkish gray (7.5YR 7/2) sand; single grain; loose; common fine and medium roots; very strongly acid; clear wavy boundary.
- Bs1—11 to 16 inches; strong brown (7.5YR 4/6) sand; single grain; loose; common fine and medium roots; weakly cemented chunks of ortstein; strongly acid; clear wavy boundary.
- Bs2—16 to 21 inches; yellowish brown (10YR 5/6) sand; many medium prominent brown (7.5YR 4/4) and common fine prominent dark brown (7.5YR 3/4) mottles; single grain; loose; about 3 percent gravel; few fine roots; medium acid; clear wavy boundary.
- C1—21 to 35 inches; very pale brown (10YR 7/4) sand; common fine distinct yellowish brown (10YR 5/8) mottles; single grain; loose; about 5 percent gravel; slightly acid; clear wavy boundary.
- C2—35 to 51 inches; yellowish brown (10YR 5/6) sand; many medium distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; about 7 percent gravel; slightly acid; clear wavy boundary.
- C3—51 to 65 inches; pale brown (10YR 6/3) sand; single grain; loose; about 5 percent gravel; neutral.

The thickness of the solum ranges from 20 to 43 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon, where it occurs, has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 1 or 2. The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 6. The C horizon has value of 4 to 7 and chroma of 3 to 6.

Some pedons have stratified very fine sand and silt loam below a depth of 40 inches.

Dawson Series

The Dawson series consists of very poorly drained soils in depressions on outwash plains and lake plains. These soils formed in herbaceous organic material 16 to 51 inches thick overlying sandy deposits. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Slope is 0 to 2 percent.

Typical pedon of Dawson peat, 2,200 feet south of

the northwest corner of sec. 4, T. 24 N., R. 1 E., Foster Township:

- Oi—0 to 6 inches; pale brown (10YR 6/3), broken face, light brownish gray (10YR 6/2), rubbed, fibric material; about 95 percent fiber, 90 percent rubbed; massive; primarily sphagnum moss fibers; extremely acid; clear smooth boundary.
- Oe—6 to 15 inches; dark reddish brown (5YR 3/2), broken face, dark reddish brown (5YR 2/2), rubbed, hemic material; about 65 percent fibers, 25 percent rubbed; primarily herbaceous material; weak medium platy structure; very friable; extremely acid; abrupt smooth boundary.
- Oa1—15 to 26 inches; very dark gray (5YR 3/1), broken face, black (5YR 2/1), rubbed, sapric material; about 25 percent fibers, 5 percent rubbed; weak medium granular structure; very friable; extremely acid; abrupt smooth boundary.
- Oa2—26 to 35 inches; black (5YR 2/1), broken face and rubbed, sapric material; about 5 percent fibers, 0 percent rubbed; massive; extremely acid; abrupt smooth boundary.
- Abg—35 to 40 inches; dark grayish brown (2.5Y 4/2) loam; massive; strongly acid; clear smooth boundary.
- Cg—40 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; strongly acid.

The depth to the C horizon ranges from 16 to 51 inches. The surface tier is dominantly fibric material, but the range includes hemic material.

The sapric material has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. The subsurface and bottom tiers are dominantly sapric material that has occasional thin layers of hemic material. The Abg horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. The Cg horizon has hue of 5YR to 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 4. It is sand, fine sand, or loamy fine sand.

East Lake Series

The East Lake series consists of somewhat excessively drained soils on outwash plains. These soils formed in sandy and gravelly glacial deposits. Permeability is rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 6 percent.

These soils have lighter colors in the upper part of the subsoil than is definitive for the East Lake series.

This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of East Lake sand, 0 to 6 percent slopes, 2,035 feet south and 50 feet east of the northwest corner of sec. 30, T. 24 N., R. 2 E., Foster Township:

- A1—0 to 1 inch; very dark grayish brown (10YR 3/2) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many fine and medium roots; strongly acid; clear wavy boundary.
- A2—1 to 2 inches; dark brown (10YR 4/3) sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; many fine and medium roots; medium acid; clear wavy boundary.
- Bw1—2 to 15 inches; yellowish brown (10YR 5/6) sand; moderate fine granular structure; very friable; about 5 percent gravel; many fine roots; medium acid; clear wavy boundary.
- Bw2—15 to 19 inches; brownish yellow (10YR 6/8) sand; moderate fine subangular blocky structure; very friable; about 10 percent gravel; few fine roots; strongly acid; clear wavy boundary.
- Bw3—19 to 35 inches; brownish yellow (10YR 6/6) sand; single grain; loose; about 5 percent gravel; medium acid; clear wavy boundary.
- 2C—35 to 60 inches; yellowish brown (10YR 5/4) very gravelly coarse sand; single grain; loose; about 60 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The content of gravel ranges from 0 to 20 percent in the solum and from 15 to 60 percent in the 2C horizon.

The A horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly sand, but the range includes loamy sand. Some pedons have an E horizon that has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 3. This horizon is sand or loamy sand. The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 2 to 8. It is sand or gravelly sand. The 2C horizon has value of 5 or 6 and chroma of 3 to 6. It is very gravelly coarse sand, gravelly sand, or gravelly coarse sand.

Epoufette Series

The Epoufette series consists of poorly drained soils on outwash plains. These soils formed in sandy material underlain by sand and gravel. Permeability is moderately rapid in the upper part of the profile and

very rapid in the lower part. Slope is 0 to 2 percent.

Typical pedon of Epoufette mucky sand, 800 feet east and 100 feet north of the southwest corner of sec. 30, T. 21 N., R. 2 E., Horton Township:

A—0 to 7 inches; black (10YR 2/1) mucky sand, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; many fine and medium roots; neutral; abrupt wavy boundary.

Eg—7 to 12 inches; dark grayish brown (2.5Y 4/2) gravelly loamy sand; common medium distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable; about 15 percent gravel; common fine and medium roots; neutral; clear wavy boundary.

Btg—12 to 25 inches; grayish brown (10YR 5/2) gravelly sandy loam; common medium faint brown (10YR 5/3) and common medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; about 20 percent gravel; few fine roots; mildly alkaline; clear wavy boundary.

2Cg—25 to 60 inches; light brownish gray (10YR 6/2) gravelly sand; single grain; loose; about 30 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The content of gravel ranges from 5 to 25 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is typically mucky sand, but the range includes sand and loamy sand. The Eg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is gravelly loamy sand, loamy sand, or sand. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is gravelly sandy loam or sandy loam. The Cg horizon has hue of 7.5YR to 5Y, value of 5 or 6, and chroma of 1 or 2. It is gravelly sand, coarse sand, or stratified sand and gravel.

Evart Series

The Evart series consists of poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope is 0 to 2 percent.

Typical pedon of Evart sand, 1,100 feet north and 130 feet west of the southeast corner of sec. 21, T. 24 N., R. 4 E., Logan Township:

A1—0 to 10 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; very friable; many fine and medium and

few coarse roots; about 1 percent gravel; neutral; clear wavy boundary.

A2—10 to 14 inches; very dark gray (10YR 3/1) sand, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium granular structure; very friable; many fine and medium and few coarse roots; about 1 percent gravel; slightly effervescent; mildly alkaline; abrupt irregular boundary.

Cg1—14 to 22 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; very dark gray (10YR 3/1) organic stains; few fine and medium roots; about 2 percent gravel; slightly effervescent; moderately alkaline; abrupt wavy boundary.

Cg2—22 to 25 inches; dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; very dark gray (10YR 3/1) organic stains; about 20 percent gravel; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C—25 to 36 inches; brown (10YR 5/3) sand; common coarse distinct yellowish brown (10YR 5/6) mottles; single grain; loose; about 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C'g—36 to 60 inches; grayish brown (10YR 5/2) sand; few medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; about 1 percent gravel; violently effervescent; moderately alkaline.

The content of gravel ranges from 1 to 25 percent throughout the profile. The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand and sandy loam. The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is sand, gravelly sand, or loamy sand.

Gladwin Series

The Gladwin series consists of somewhat poorly drained soils on outwash plains. These soils formed in sandy material underlain by sand and gravel. Permeability is rapid and moderately rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Gladwin sand, 0 to 3 percent slopes, 250 feet north and 350 feet east of the center of sec. 7, T. 22 N., R. 4 E., Logan Township:

A—0 to 3 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; many fine and medium roots; about 3 percent

- gravel; medium acid; abrupt wavy boundary.
- E—3 to 9 inches; grayish brown (10YR 5/2) sand; weak fine granular structure; very friable; many fine and medium roots; about 3 percent gravel; strongly acid; abrupt wavy boundary.
- Bs—9 to 15 inches; brown (10YR 4/3) sand; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; common fine and few medium roots; about 10 percent gravel; slightly acid; clear wavy boundary.
- Bt—15 to 22 inches; dark brown (10YR 3/3) gravelly sandy loam; common fine distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; about 17 percent gravel; slightly acid; clear wavy boundary.
- C—22 to 41 inches; brown (10YR 5/3) sand; single grain; loose; about 5 percent gravel; strongly effervescent; mildly alkaline; clear wavy boundary.
- Cg—41 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; about 17 percent gravel; violently effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The content of gravel ranges from 3 to 25 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand and sandy loam. The E horizon has value of 5 or 6 and chroma of 2 or 3. It is sand, loamy sand, or sandy loam. The Bs horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 3 or 4. It is loamy sand or sand. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is gravelly sandy loam, sandy loam, or gravelly loamy sand. The C horizon has value of 4 to 7 and chroma of 2 to 4. It is gravelly coarse sand, gravelly sand, sand, or stratified sand and gravel.

Graycalm Series

The Graycalm series consists of somewhat excessively drained, rapidly permeable soils on outwash plains and moraines. These soils formed in sandy glacial deposits. Slope ranges from 0 to 35 percent.

Typical pedon of Graycalm sand, 0 to 6 percent slopes, 1,320 feet south and 1,850 feet east of the northwest corner of sec. 3, T. 23 N., R. 2 E., Klacking Township:

- A—0 to 2 inches; black (10YR 2/1) sand, dark gray

(10YR 4/1) dry; weak fine granular structure; very friable; many fine and common medium roots; strongly acid; abrupt wavy boundary.

- Bw1—2 to 14 inches; strong brown (7.5YR 4/6) sand; weak medium granular structure; friable; many fine and medium and few coarse roots; about 3 percent gravel; medium acid; clear smooth boundary.

- Bw2—14 to 26 inches; yellowish brown (10YR 5/6) sand; weak medium granular structure; friable; many fine and common medium roots; about 3 percent gravel; medium acid; clear smooth boundary.

- BC—26 to 44 inches; brownish yellow (10YR 6/6) sand; weak medium subangular blocky structure; friable; few coarse and medium roots; about 2 percent gravel; medium acid; clear smooth boundary.

- E&Bt—44 to 76 inches; light yellowish brown (10YR 6/4) sand (E) and bands of strong brown (7.5YR 4/6) loamy sand (Bt); single grain; loose; bands are $\frac{1}{8}$ to $\frac{1}{4}$ inch thick with a total accumulation of 2 inches; about 2 percent gravel; medium acid.

The thickness of the solum ranges from 40 inches to more than 76 inches. The depth to the E&Bt horizon ranges from 25 to 48 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand. The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sand or loamy sand. The E part of the E&Bt horizon has hue of 10YR or 7.5YR and value of 5 or 6. The B part of this horizon consists of bands of loamy sand or sand $\frac{1}{8}$ inch to 2 inches thick. The combined thickness of the bands is less than 6 inches. The B part has hue of 10YR or 7.5YR and value and chroma of 4 to 6. The C horizon, where it occurs, is sand. It has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4.

Grayling Series

The Grayling series consists of excessively drained, rapidly permeable soils on outwash plains. These soils formed in deep sandy deposits. Slope ranges from 0 to 35 percent.

Typical pedon of Grayling sand, 0 to 6 percent slopes, 2,640 feet north and 1,300 feet east of the southwest corner of sec. 17, T. 24 N., R. 1 E., Foster Township:

- A—0 to 5 inches; very dark grayish brown (10YR 3/2)

sand, dark brown (10YR 4/3) dry; weak fine granular structure; very friable; strongly acid; abrupt wavy boundary.

Bw1—5 to 13 inches; dark yellowish brown (10YR 4/6) sand; weak fine subangular blocky structure; very friable; strongly acid; clear wavy boundary.

Bw2—13 to 30 inches; yellowish brown (10YR 5/6) sand; weak medium subangular blocky structure; very friable; strongly acid; clear wavy boundary.

C1—30 to 43 inches; brownish yellow (10YR 6/6) sand; single grain; loose; strongly acid; clear wavy boundary.

C2—43 to 68 inches; very pale brown (10YR 7/4) sand; single grain; loose; medium acid.

The thickness of the solum ranges from 19 to 34 inches. The content of gravel ranges from 0 to 5 percent in the solum.

The A horizon has value of 2 to 4 and chroma of 1 to 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 3 to 8. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 6.

Grousehaven Series

The Grousehaven series consists of very poorly drained soils in bogs that were postglacial lakes. These soils are on outwash plains or moraines. They formed in herbaceous organic material over marl. Permeability is moderately slow to moderately rapid in the organic material and slow or very slow in the marl. Slope is 0 to 2 percent.

Typical pedon of Grousehaven muck, 300 feet south and 1,850 feet east of the northwest corner of sec. 27, T. 21 N., R. 1 E., Edwards Township:

Oa—0 to 7 inches; black (10YR 2/1), broken face and rubbed, sapric material; weak fine granular structure; very friable; many fine roots; about 40 percent silt loam; moderately alkaline; abrupt smooth boundary.

Cg1—7 to 41 inches; white (10YR 8/1) marl; massive; friable; slightly sticky; many snail shell fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Cg2—41 to 60 inches; light gray (10YR 7/1) marl; few medium prominent brownish yellow (10YR 6/6) and few fine prominent yellowish brown (10YR 5/8) mottles; massive; friable; slightly sticky; common snail shell fragments; violently effervescent; moderately alkaline.

The depth to the marl ranges from 6 to 16 inches. The organic material is primarily herbaceous.

The surface layer has hue of 5YR to 2.5Y. The C horizon has value of 7 or 8 and chroma of 1 or 2.

Ingalls Series

The Ingalls series consists of somewhat poorly drained soils on lake plains. These soils formed in sandy material over stratified loamy and sandy glaciofluvial deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Ingalls sand, 0 to 3 percent slopes, 2,200 feet west and 1,500 feet north of the southeast corner of sec. 24, T. 23 N., R. 4 E., Hill Township:

Oe—3 inches to 0; black (10YR 2/1) decomposed and undecomposed leaf litter; abrupt smooth boundary.

A—0 to 2 inches; black (N 2/0) sand; weak fine granular structure; very friable; many fine and few medium and coarse roots; strongly acid; gradual wavy boundary.

E—2 to 12 inches; pinkish gray (7.5YR 7/2) sand; few fine distinct brown (7.5YR 4/2) mottles; single grain; loose; few fine and common medium and coarse roots; strongly acid; clear wavy boundary.

Bs—12 to 22 inches; dark brown (7.5YR 3/4) loamy sand; weak medium subangular blocky structure; friable; few dark brown (7.5YR 3/4) chunks of strongly cemented ortstein; few coarse roots; medium acid; abrupt smooth boundary.

2C—22 to 60 inches; yellowish brown (10YR 5/6), pinkish gray (7.5YR 6/2), and light brown (7.5YR 6/4), stratified very fine sandy loam, loamy very fine sand, sandy loam, and sand; common medium distinct light yellowish brown (10YR 6/4) and few fine distinct light brownish gray (10YR 6/2) and light gray (10YR 7/2) mottles; massive; friable; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 19 to 35 inches. The content of gravel ranges from 0 to 5 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 0 to 2. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 3. The Bs horizon has hue of 7.5YR or 10YR and value and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. It includes strata of sand, fine sand, loamy very fine sand, sandy loam, very fine sandy

loam, or silt loam with occasional thin strata of silty clay loam.

Iosco Series

The Iosco series consists of somewhat poorly drained soils on ground moraines and outwash plains. These soils formed in sandy material overlying loamy and silty deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 4 percent.

Typical pedon of Iosco sand, 0 to 4 percent slopes, 2,340 feet east and 1,200 feet north of the southwest corner of sec. 28, T. 22 N., R. 3 E., Mills Township:

- A—0 to 5 inches; black (N 2/0) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine and common medium roots; strongly acid; abrupt wavy boundary.
- E—5 to 9 inches; brown (7.5YR 5/2) sand; single grain; loose; many fine and common medium roots; strongly acid; clear wavy boundary.
- Bs1—9 to 16 inches; yellowish brown (10YR 5/4) sand; few medium faint grayish brown (10YR 5/2) mottles; single grain; loose; few fine roots; medium acid; clear wavy boundary.
- Bs2—16 to 25 inches; yellowish brown (10YR 5/6) sand; common fine distinct strong brown (7.5YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; single grain; loose; few fine roots; slightly acid; clear wavy boundary.
- Bs3—25 to 34 inches; yellowish brown (10YR 5/4) sand; few fine prominent strong brown (7.5YR 5/6) and few medium faint grayish brown (10YR 5/2) mottles; single grain; loose; about 2 percent gravel; neutral; abrupt wavy boundary.
- Bt—34 to 37 inches; dark brown (7.5YR 4/4) sandy loam; common fine distinct brown (7.5YR 4/2) mottles; weak medium subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.
- 2C—37 to 60 inches; reddish brown (5YR 5/3) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and greenish gray (5BG 5/1) mottles; massive; firm; strongly effervescent; moderately alkaline.

The depth to the loamy and silty material ranges from 20 to 40 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 0 to 2. It is dominantly sand, but the range includes loamy sand. The E horizon has hue

of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 or 2. It is sand, fine sand, loamy sand, or loamy fine sand. The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. It is sand, fine sand, or loamy sand. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam or loam. The 2C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam or clay loam.

Isabella Series

The Isabella series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial deposits. Slope ranges from 0 to 40 percent.

Typical pedon of Isabella loamy sand, 2 to 6 percent slopes, 1,320 feet north and 530 feet east of the southwest corner of sec. 33, T. 23 N., R. 2 E., Klacking Township:

- O—2 inches to 0; black (N 2/0) partially decomposed forest litter; weak fine granular structure; very friable; abrupt smooth boundary.
- AE—0 to 1 inch; dark brown (7.5YR 3/2) loamy sand; weak fine granular structure; friable; many fine and medium roots; about 3 percent gravel; very strongly acid; abrupt smooth boundary.
- E—1 to 3 inches; pinkish gray (7.5YR 6/2) loamy sand; weak fine subangular blocky structure; very friable; many fine and medium roots; about 7 percent gravel; very strongly acid; abrupt wavy boundary.
- Bs—3 to 12 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; many fine to coarse roots; about 6 percent gravel; strongly acid; clear wavy boundary.
- E'—12 to 16 inches; brown (10YR 5/3) sandy loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure parting to weak thin platy; firm; brittle when dry; many medium and coarse roots; about 9 percent gravel; medium acid; gradual irregular boundary.
- E/B—16 to 24 inches; brown (10YR 5/3) sandy loam (E) surrounding peds of dark brown (7.5YR 4/4) sandy clay loam (Bt); weak medium subangular blocky structure; firm, with some pockets of friable E material; few fine roots; about 3 percent gravel; medium acid; gradual irregular boundary.
- Bt—24 to 33 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium angular blocky structure parting to moderate fine subangular blocky; firm; many faint strong brown (7.5YR 5/6) clay coatings

on faces of peds; few fine roots between cleavage planes of peds; about 8 percent gravel; medium acid; clear wavy boundary.

C—33 to 60 inches; brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure; friable; few fine roots between cleavage planes of peds; about 12 percent gravel; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 32 to 48 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 0 to 2. It is dominantly loamy sand, but the range includes sandy loam and fine sandy loam. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. It has textures similar to those of the A horizon. The Bs horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, or loam. The E' horizon and the E part of the E/B horizon have hue, value, chroma, and texture similar to those of the E horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 or 4. It is loam, clay loam, or sandy clay loam. The C horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4. It is sandy clay loam, clay loam, loam, or fine sandy loam.

Kawkawlin Series

The Kawkawlin series consists of somewhat poorly drained, slowly permeable soils on ground moraines. These soils formed in loamy and clayey glacial deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Kawkawlin loam, 0 to 4 percent slopes, 120 feet west and 1,848 feet south of the northeast corner of sec. 14, T. 21 N., R. 1 E., Edwards Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; slightly acid; abrupt wavy boundary.

B/E—9 to 13 inches; brown (10YR 4/3) clay loam (Bt) and light brownish gray (10YR 6/2) fine sandy loam (E); moderate medium subangular blocky structure; firm; about 2 percent gravel; slightly acid; discontinuous wavy boundary.

Bt1—13 to 19 inches; brown (10YR 4/3) clay loam; many fine faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky

structure; firm; many thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

Bt2—19 to 31 inches; brown (10YR 4/3) clay; many medium prominent strong brown (7.5YR 5/6) and few fine distinct greenish gray (5GY 6/1) mottles; strong medium subangular blocky structure; very firm; many medium continuous brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; mildly alkaline; clear wavy boundary.

Cg1—31 to 39 inches; yellowish brown (10YR 5/4) clay loam; common fine prominent greenish gray (5GY 6/1), common fine faint grayish brown (10YR 5/2), and common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 3 percent gravel; slightly effervescent; mildly alkaline; clear wavy boundary.

Cg2—39 to 60 inches; brown (10YR 5/3) clay loam; common fine faint light brownish gray (10YR 6/2), common fine distinct yellowish brown (10YR 5/6), and few fine prominent greenish gray (5GY 6/1) mottles; massive; firm; about 3 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 18 to 32 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam. The E horizon, where it occurs, has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 3 or 4. It is silty clay loam, clay loam, or clay. The Cg horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam or clay loam.

Kent Series

The Kent series consists of well drained and moderately well drained, slowly permeable soils on till plains and moraines. These soils formed in clayey glacial deposits. Slope ranges from 0 to 18 percent.

Typical pedon of Kent sandy loam, 2 to 6 percent slopes, 700 feet east and 400 feet north of the southwest corner of sec. 9, T. 22 N., R. 4 E., Logan Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; about

3 percent gravel; neutral; abrupt smooth boundary.
 B/E—9 to 14 inches; strong brown (7.5YR 4/6) clay (Bt) and brown (10YR 5/3) sandy loam (E); weak thin platy structure; friable; about 3 percent gravel; neutral; abrupt irregular boundary.

Bt—14 to 23 inches; dark brown (7.5YR 3/4) clay; strong medium angular blocky structure; very firm; about 3 percent gravel; many thick dark reddish gray (5YR 4/2) clay films on faces of peds; very dark grayish brown (10YR 3/2) organic stains along root channels; mildly alkaline; abrupt wavy boundary.

C1—23 to 37 inches; brown (7.5YR 5/4) clay; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; very firm; about 6 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—37 to 60 inches; brown (7.5YR 5/4) clay; many medium distinct strong brown (7.5YR 5/6) mottles; massive; very firm; about 9 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 18 to 30 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 or 2. It is sandy loam or loam. The Bt part of the B/E horizon has hue of 5Y to 10YR, value of 3 to 5, and chroma of 3 to 6. The E part of the B/E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 or 3. It is sandy loam, clay loam, or clay. The Bt horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 or 4. It is clay or silty clay. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is clay or silty clay.

Klacking Series

The Klacking series consists of well drained soils on moraines and outwash plains. These soils formed in sandy glacial deposits. Permeability is rapid in the upper part and moderately rapid in the lower part. Slope ranges from 0 to 35 percent.

Typical pedon of Klacking sand, 6 to 18 percent slopes, 2,400 feet north and 1,500 feet east of the southwest corner of sec. 7, T. 24 N., R. 4 E., Goodar Township:

A—0 to 2 inches; black (10YR 2/1) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many fine and common medium roots;

strongly acid; abrupt smooth boundary.

Bw1—2 to 12 inches; yellowish brown (10YR 5/8) sand; weak fine granular structure; friable; many fine and medium and common coarse roots; about 7 percent gravel; strongly acid; clear wavy boundary.

Bw2—12 to 24 inches; dark yellowish brown (10YR 4/6) sand; weak fine granular structure; friable; many fine and common medium roots; about 9 percent gravel; slightly acid; clear wavy boundary.

Bw3—24 to 34 inches; yellowish brown (10YR 5/6) sand; weak fine granular structure; friable; common medium and few fine roots; about 11 percent gravel; slightly acid; clear irregular boundary.

E&Bt—34 to 44 inches; yellowish brown (10YR 5/4) sand (E) and strong brown (7.5YR 4/6) loamy sand (Bt); weak fine subangular blocky structure; friable; few fine and medium roots; about 9 percent gravel; slightly acid; abrupt irregular boundary.

B/E—44 to 82 inches; 60 percent strong brown (7.5YR 4/6) sandy loam (Bt) and 40 percent light yellowish brown (10YR 6/4) sand (E); moderate medium subangular blocky structure; friable; few fine and medium roots; about 6 percent gravel; neutral.

The thickness of the solum ranges from 35 inches to more than 60 inches. The content of gravel and cobbles ranges from 0 to 10 percent throughout the solum.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is sand or loamy sand. The E part of the E&Bt and B/E horizons has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is sand or loamy sand. The Bt part of the E&Bt horizon consists of bands of loamy sand or sandy loam ¼ inch to 4 inches thick. The combined thickness of the bands is more than 6 inches. The Bt part has hue of 5YR to 10YR and value and chroma of 4 to 6. Some pedons have a C horizon.

Loxley Series

The Loxley series consists of very poorly drained soils in bogs on outwash plains, lake plains, and moraines. These soils formed in deep herbaceous organic deposits. Permeability is moderately slow to moderately rapid. Slope is 0 to 2 percent.

Typical pedon of Loxley peat, 1,300 feet north and 1,750 feet east of the southwest corner of sec. 31, T. 23 N., R. 1 E., Foster Township:

Oi—0 to 12 inches; dark brown (7.5YR 4/4), broken

face, dark yellowish brown (10YR 4/4), rubbed, fibric material; 100 percent fibers, 80 percent rubbed; extremely acid; abrupt smooth boundary.

Oa1—12 to 42 inches; dark reddish brown (5YR 2/2), broken face and rubbed, sapric material; about 45 percent fibers, 5 percent rubbed; weak medium granular structure; friable; extremely acid; abrupt smooth boundary.

Oa2—42 to 60 inches; black (5YR 2/1), broken face and rubbed, sapric material; about 20 percent fibers, 0 percent rubbed; about 1 percent mineral content; weak medium granular structure; friable; very strongly acid.

The thickness of the sapric material ranges from 51 inches to more than 60 inches. All layers have hue of 5YR to 10YR, value of 2 to 5, and chroma of 1 to 4.

Lupton Series

The Lupton series consists of very poorly drained soils in depressions on outwash plains, lake plains, and till plains. These soils formed in deep woody and herbaceous organic material. Permeability is moderately slow to moderately rapid. Slope is 0 to 2 percent.

Typical pedon of Lupton muck, 1,584 feet south and 50 feet east of the northwest corner of sec. 33, T. 24 N., R. 4 E., Goodar Township:

Oa1—0 to 4 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 30 percent woody fibers, 15 percent rubbed; weak medium granular structure; friable; neutral; clear wavy boundary.

Oa2—4 to 40 inches; black (N 2/0), broken face and rubbed, sapric material; about 25 percent fibers, 10 percent rubbed; weak coarse granular structure; friable; neutral; gradual wavy boundary.

Oa3—40 to 60 inches; black (5YR 2/1), broken face and rubbed, sapric material; about 30 percent fibers, 10 percent rubbed; weak medium granular structure; friable; neutral.

The thickness of the sapric material ranges from 51 inches to more than 60 inches. All organic layers have hue of 5YR to 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2.

Mancelona Series

The Mancelona series consists of somewhat excessively drained soils on outwash plains, kames, and moraines. These soils formed in sandy and gravelly glacial deposits. Permeability is rapid and moderately

rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 50 percent.

Typical pedon of Mancelona sand, 0 to 6 percent slopes, 1,400 feet south and 50 feet east of the northwest corner of sec. 30, T. 24 N., R. 2 E., Foster Township:

A—0 to 1 inch; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine and common medium roots; strongly acid; abrupt wavy boundary.

E—1 to 3 inches; dark grayish brown (10YR 4/2) sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine and common medium roots; medium acid; clear irregular boundary.

Bs1—3 to 15 inches; dark yellowish brown (10YR 4/4) sand; weak fine subangular blocky structure; very friable; common fine and medium and few coarse roots; medium acid; clear wavy boundary.

Bs2—15 to 28 inches; brownish yellow (10YR 6/6) sand; weak medium subangular blocky structure; very friable; many fine, common medium, and few coarse roots; medium acid; clear wavy boundary.

Bt—28 to 39 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; friable; many fine and common medium roots; about 15 percent gravel; slightly acid; clear wavy boundary.

2C1—39 to 54 inches; light yellowish brown (10YR 6/4) gravelly sand; single grain; loose; about 25 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

2C2—54 to 58 inches; brown (10YR 5/3) very gravelly sand; single grain; loose; about 40 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

3C3—58 to 68 inches; very pale brown (10YR 7/3) sand; single grain; loose; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 26 to 40 inches. The content of pebbles ranges from 0 to 30 percent in the solum and from 10 to 45 percent in the C horizon. The content of cobbles ranges from 0 to 3 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand and sandy loam. Some pedons have an E horizon. The Bs horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is

sand, loamy sand, or the gravelly analogs of these textures. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly gravelly sandy loam, but the range includes loamy sand, gravelly loamy sand, and sandy clay loam. The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 3 or 4. It is gravelly sand, gravelly coarse sand, very gravelly sand, or sand.

Manistee Series

The Manistee series consists of well drained soils on moraines, till plains, and outwash plains. These soils formed in sandy deposits underlain by clayey deposits. Permeability is rapid in the upper part of the profile and slow in the lower part. Slope ranges from 0 to 18 percent.

Typical pedon of Manistee loamy sand, 0 to 6 percent slopes, 1,800 feet north and 200 feet east of the southwest corner of sec. 20, T. 21 N., R. 4 E., Richland Township:

- Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; slightly acid; abrupt smooth boundary.
- E—11 to 15 inches; light brownish gray (10YR 6/2) sand; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.
- Bs—15 to 21 inches; brown (7.5YR 4/4) sand; moderate coarse subangular blocky structure; very friable; about 40 percent reddish brown (5YR 4/3) weakly cemented ortstein; neutral; abrupt wavy boundary.
- 2E/B—21 to 33 inches; brown (7.5YR 5/2) clay loam (E) and dark brown (7.5YR 4/4) clay loam (Bt); moderate medium subangular blocky structure; firm; neutral; clear wavy boundary.
- 2Bt1—33 to 39 inches; brown (7.5YR 5/4) clay loam; strong medium subangular blocky structure; firm; mildly alkaline; clear wavy boundary.
- 2Bt2—39 to 50 inches; dark brown (7.5YR 4/4) clay; strong medium subangular blocky structure; very firm; mildly alkaline; clear wavy boundary.
- 2C—50 to 60 inches; dark brown (7.5YR 4/4) clay; massive; very firm; slightly effervescent; mildly alkaline.

The depth to the 2E/B horizon ranges from 20 to 35 inches. The content of gravel ranges from 0 to 10 percent in the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 or 2. It is dominantly loamy

sand, but the range includes sand and loamy fine sand. The E horizon has hue and texture similar to those of the Ap horizon. It has value of 4 to 6 and chroma of 2 or 3. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. The 2Bt horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 or 4. It is clay, silty clay, or clay loam. The C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 or 4. It is clay or silty clay.

Melita Series

The Melita series consists of somewhat excessively drained soils on till plains, outwash plains, and moraines. These soils formed in sandy deposits underlain by loamy deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 40 percent.

Typical pedon of Melita sand, 0 to 6 percent slopes, 500 feet east and 100 feet south of the northwest corner of sec. 18, T. 24 N., R. 1 E., Foster Township:

- A1—0 to 1 inch; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine and medium roots; extremely acid; abrupt wavy boundary.
- A2—1 to 2 inches; very dark grayish brown (10YR 3/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine and medium roots; extremely acid; clear wavy boundary.
- Bs1—2 to 9 inches; dark brown (7.5YR 3/4) sand; weak medium granular structure; very friable; few fine roots; strongly acid; clear wavy boundary.
- Bs2—9 to 23 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; slightly acid; clear wavy boundary.
- Bs3—23 to 42 inches; yellowish brown (10YR 5/6) sand; single grain; loose; medium acid; clear wavy boundary.
- Bw—42 to 52 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; slightly acid; clear wavy boundary.
- 2B/E—52 to 60 inches; yellowish brown (10YR 5/4) clay loam (Bt) and pale brown (10YR 6/3) very fine sandy loam (E); weak medium subangular blocky structure; friable; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sand, but

the range includes loamy sand. Some pedons have an E horizon. This horizon has hue and texture similar to those of the A horizon. It has value of 4 to 6 and chroma of 2. The Bs and Bw horizons have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. The Bt part of the 2B/E horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is loam, clay loam, or silty clay loam. The E part of this horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is very fine sandy loam or loamy sand. Some pedons have a 2C horizon.

Menominee Series

The Menominee series consists of well drained soils on moraines and till plains. These soils formed in sandy materials underlain by loamy glacial deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 35 percent.

Typical pedon of Menominee sand, .6 to 12 percent slopes, 2,640 feet south and 400 feet east of the northwest corner of sec. 33, T. 23 N., R. 2 E., Klacking Township:

- A—0 to 3 inches; very dark grayish brown (10YR 3/2) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine and medium roots; very strongly acid; abrupt wavy boundary.
- E—3 to 8 inches; light brownish gray (10YR 6/2) sand; weak fine granular structure; friable; many medium and common fine roots; very strongly acid; clear wavy boundary.
- Bs1—8 to 18 inches; dark brown (7.5YR 3/4) sand; weak medium granular structure; friable; many medium and common fine roots; medium acid; clear wavy boundary.
- Bs2—18 to 30 inches; dark yellowish brown (10YR 4/6) sand; weak medium subangular blocky structure; friable; few fine roots; medium acid; clear wavy boundary.
- 2B/E—30 to 40 inches; strong brown (7.5YR 4/6) clay loam (Bt) and brown (7.5YR 5/2) sandy loam (E); moderate medium subangular blocky structure; firm; slightly acid; clear wavy boundary.
- 2C—40 to 60 inches; brown (7.5YR 5/4) clay loam; massive; firm; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 34 to 56 inches. The thickness of the sandy upper horizons ranges from 20 to 40 inches. The content of gravel

ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 0 to 2. It is dominantly sand, but the range includes loamy sand. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 or 3. The Bs horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The E part of this horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is loamy sand or sandy loam. The B part of this horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, sandy clay loam, or loam. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam or loam.

Montcalm Series

The Montcalm series consists of well drained, moderately rapidly permeable soils on moraines and outwash plains. These soils formed in sandy and loamy deposits. Slopes range from 0 to 35 percent.

Typical pedon of Montcalm loamy sand, 6 to 18 percent slopes, 3,040 feet east and 600 feet south of the northwest corner of sec. 33, T. 23 N., R. 2 E., Klacking Township:

- A—0 to 1 inch; dark grayish brown (10YR 4/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine and medium roots; about 2 percent gravel; very strongly acid; clear wavy boundary.
- E—1 to 6 inches; grayish brown (10YR 5/2) loamy sand; weak fine granular structure; very friable; many fine and medium roots; about 2 percent gravel; very strongly acid; clear wavy boundary.
- Bw—6 to 30 inches; light yellowish brown (10YR 6/4) loamy sand; weak medium granular structure; very friable; few fine and medium roots; about 2 percent gravel; strongly acid; clear wavy boundary.
- Bt1—30 to 42 inches; strong brown (7.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; friable; few fine and medium roots; about 5 percent gravel; neutral; clear wavy boundary.
- Bt2—42 to 50 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; about 5 percent gravel; slightly acid; clear wavy boundary.
- E&Bt1—50 to 55 inches; yellowish brown (10YR 5/4) loamy sand (E) and dark yellowish brown (10YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few medium roots; about 5 percent gravel; slightly acid; clear wavy boundary.

E&Bt2—55 to 60 inches; brownish yellow (10YR 6/6) loamy sand (E) and yellowish brown (10YR 5/6) sandy loam (Bt); moderate medium subangular blocky structure; friable; about 3 percent gravel; slightly acid.

The thickness of the solum ranges from 40 to 74 inches. The content of gravel ranges from 2 to 15 percent throughout the profile.

The E horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 5 to 7 and chroma of 0. Some pedons have an A horizon that has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A and E horizons are dominantly loamy sand, but the range includes sand. The Bw horizon has value and chroma of 4 to 6. It is sand or loamy sand. The Bt horizon and the B part of the E&Bt horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are sandy loam or sandy clay loam. The E part of the E&Bt horizon has value of 5 to 7 and chroma of 3 or 4. Some pedons have a C horizon.

Nester Series

The Nester series consists of well drained, slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. Slope ranges from 2 to 50 percent.

Typical pedon of Nester fine sandy loam, 2 to 6 percent slopes, 1,450 feet west and 260 feet north of the southeast corner of sec. 14, T. 21 N., R. 1 E., Edwards Township:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

B/E—8 to 13 inches; dark brown (7.5YR 4/4) loam (Bt) and brown (10YR 5/3) fine sandy loam (E); strong medium subangular blocky structure; firm; neutral; clear wavy boundary.

Bt—13 to 21 inches; dark yellowish brown (10YR 4/6) clay loam; strong medium subangular blocky structure; firm; many thin dark yellowish brown (10YR 4/4) clay films on faces of peds and in root channels; neutral; clear wavy boundary.

BC—21 to 35 inches; yellowish brown (10YR 5/4) clay loam; strong medium subangular blocky structure; firm; strongly effervescent; moderately alkaline; clear wavy boundary.

C—35 to 60 inches; yellowish brown (10YR 5/4)

clay loam; massive; firm; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 39 inches. The content of gravel ranges from 0 to 7 percent throughout the profile.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is fine sandy loam, sandy loam, loam, or clay loam. Some pedons have an E horizon. This horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or clay. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is clay loam or silty clay loam.

Pickford Series

The Pickford series consists of poorly drained, very slowly permeable soils on till plains and in depressional areas of moraines. These soils formed in clayey glacial till. Slope is 0 to 2 percent.

Typical pedon of Pickford silty clay loam, 235 feet south and 1,200 feet east of the northwest corner of sec. 35, T. 22 N., R. 4 E., Logan Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; firm; neutral; abrupt smooth boundary.

Bg1—9 to 17 inches; gray (5Y 5/1) clay; common medium prominent brownish yellow (10YR 6/8) and few coarse distinct greenish gray (5GY 6/1) mottles; massive; firm; neutral; clear wavy boundary.

Bg2—17 to 30 inches; gray (5Y 5/1) clay; many coarse prominent yellowish brown (10YR 5/6) and common coarse faint light gray (5Y 6/1) mottles; massive; firm; mildly alkaline; clear wavy boundary.

C—30 to 60 inches; light gray (5Y 6/1) clay; many common prominent light olive brown (2.5Y 5/6) mottles; massive; very firm; violently effervescent; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 14 to 30 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes loam and clay loam. The Bg horizon has hue of 5YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay or silty clay. The C horizon has value of 4 to 6 and chroma of 1 to 4.

Rondeau Series

The Rondeau series consists of very poorly drained soils in bogs that were postglacial lakes. These soils are on outwash plains and ground moraines. They formed in herbaceous organic material over marl. Permeability is moderately slow to moderately rapid in the organic material and slow or very slow in the marl. Slope is 0 to 2 percent.

Typical pedon of Rondeau muck, 825 feet south and 50 feet east of the northwest corner of sec. 33, T. 24 N., R. 4 E., Goodar Township:

- Oi—0 to 4 inches; black (5YR 2/1), broken face, dark reddish brown (5YR 2/2), rubbed, sapric material; about 30 percent fibers, 15 percent rubbed; primarily herbaceous fibers; neutral; abrupt smooth boundary.
- Oa1—4 to 9 inches; black (5YR 2/1), broken face and rubbed, sapric material; about 25 percent fibers, 5 percent rubbed; primarily herbaceous material; neutral; abrupt smooth boundary.
- Oa2—9 to 19 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 75 percent fibers, 15 percent rubbed; primarily herbaceous material; neutral; abrupt smooth boundary.
- Cg1—19 to 48 inches; light brownish gray (10YR 6/2) marl; massive; violently effervescent; mildly alkaline; gradual wavy boundary.
- Cg2—48 to 60 inches; light gray (10YR 7/2) marl; massive; violently effervescent; mildly alkaline; gradual wavy boundary.

The depth to the C horizon ranges from 16 to 50 inches. The organic material is primarily herbaceous, but woody fragments are mixed throughout the organic layers of many pedons.

The organic layers have hue of 5YR to 10YR. The Cg horizon has hue of 10YR to 5Y, value of 6 or 7, and chroma of 1 or 2. It commonly contains snail shells.

Roscommon Series

The Roscommon series consists of poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy glaciofluvial deposits. Slope is 0 to 2 percent.

Typical pedon of Roscommon mucky sand, 2,100 feet south and 200 feet east of the northwest corner of sec. 32, T. 23 N., R. 3 E., Mills Township:

- A—0 to 5 inches; black (N 2/0) mucky sand, dark gray

(10YR 4/1) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; medium acid; abrupt smooth boundary.

- Cg—5 to 9 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; common fine and medium roots; medium acid; clear wavy boundary.

- C—9 to 18 inches; brown (10YR 5/3) sand; single grain; loose; medium acid; clear wavy boundary.

- C'g—18 to 30 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; slightly acid; clear wavy boundary.

- C'—30 to 60 inches; brown (10YR 4/3) sand; single grain; loose; neutral.

The content of gravel ranges from 0 to 10 percent throughout the profile. The A horizon has value of 2 or 3 and chroma of 0 or 1. It is dominantly mucky sand, but the range includes sand and loamy sand. Some pedons have an Oa horizon about 5 inches thick. The C horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 or 3.

Rubicon Series

The Rubicon series consists of excessively drained, rapidly permeable soils on outwash plains, glacial drainageways, kames, and moraines. These soils formed in sandy glacial deposits. Slope ranges from 0 to 50 percent.

Typical pedon of Rubicon sand, 0 to 6 percent slopes, 3,150 feet south and 360 feet west of the northeast corner of sec. 15, T. 21 N., R. 2 E., Horton Township:

- A—0 to 1 inch; black (N 2/0) sand, very dark gray (10YR 3/1) dry; single grain; loose; many fine and medium and few coarse roots; strongly acid; abrupt smooth boundary.
- E—1 to 3 inches; grayish brown (10YR 5/2) sand; single grain; loose; many fine and medium and few coarse roots; strongly acid; abrupt wavy boundary.
- Bs1—3 to 10 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; common fine to coarse roots; strongly acid; clear wavy boundary.
- Bs2—10 to 17 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; few fine roots; medium acid; clear wavy boundary.
- BC—17 to 38 inches; brownish yellow (10YR 6/6) sand; single grain; loose; medium acid; clear wavy boundary.

C1—38 to 50 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; medium acid; clear wavy boundary.

C2—50 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; medium acid.

The thickness of the solum ranges from 23 to 40 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 4 and chroma of 0 to 2. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. The Bs horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. The C horizon has value of 5 to 7 and chroma of 4 to 6. Banded substratum phases have thin bands of loamy sand $\frac{1}{16}$ to $\frac{1}{4}$ inch thick below a depth of 40 inches.

Selkirk Series

The Selkirk series consists of somewhat poorly drained, slowly permeable soils on till plains and moraines. These soils formed in clayey deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Selkirk loam, 0 to 4 percent slopes, 1,320 feet north and 30 feet west of the southeast corner of sec. 33, T. 23 N., R. 4 E., Logan Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; mildly alkaline; abrupt smooth boundary.

Bt—10 to 16 inches; dark brown (7.5YR 4/4) clay; common fine distinct brown (7.5YR 5/2) and strong brown (7.5YR 5/6) mottles; strong fine subangular blocky structure; very firm; many thick continuous dark brown (7.5YR 3/2) clay films on faces of peds; mildly alkaline; clear wavy boundary.

C1—16 to 28 inches; reddish brown (5YR 5/3) clay; few faint distinct yellowish red (5YR 5/6) and few medium faint pinkish gray (5YR 6/2) mottles; strong angular blocky structure; very firm; violently effervescent; moderately alkaline; clear wavy boundary.

C2—28 to 60 inches; dark brown (7.5YR 4/4) clay; few fine distinct strong brown (7.5YR 5/6) mottles; massive; very firm; many medium prominent white (10YR 8/1) lime streaks; violently effervescent; moderately alkaline.

The thickness of the solum and the depth to

carbonates range from 16 to 28 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam. Some pedons have an E/B horizon. The E part of this horizon consists of coatings on peds of B material. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is clay or silty clay. The C horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is clay or silty clay.

Sims Series

The Sims series consists of poorly drained, slowly permeable soils on till plains and in depressional areas of moraines. These soils formed in silty deposits. Slope is 0 to 2 percent.

Typical pedon of Sims loam, 792 feet north and 660 feet west of the southeast corner of sec. 8, T. 21 N., R. 1 E., Edwards Township:

Ap—0 to 6 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

Bg1—6 to 11 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6 and 10YR 5/4) mottles; moderate medium subangular blocky structure; firm; about 2 percent gravel; mildly alkaline; clear wavy boundary.

Bg2—11 to 17 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6 and 10YR 5/4) and common medium prominent brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; very firm; about 3 percent gravel; mildly alkaline; clear wavy boundary.

Cg1—17 to 25 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4 and 10YR 5/6) and common medium prominent brownish yellow (10YR 6/8) mottles; massive; very firm; about 3 percent gravel; strongly effervescent; mildly alkaline; clear wavy boundary.

Cg2—25 to 60 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6 and 10YR 5/4) mottles; massive; very firm; about 3 percent gravel; many distinct white (10YR 8/1) lime streaks; strongly effervescent; moderately alkaline.

The thickness of the solum and the depth to

carbonates range from 17 to 28 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loam, but the range includes silty clay loam. The Bg horizon has value of 5 to 7 and chroma of 1 or 2. It is silty clay loam or clay loam. The Cg horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 4. It is silty clay loam or clay loam.

Tawas Series

The Tawas series consists of very poorly drained soils in depressions on outwash plains, lake plains, till plains, and moraines. The soils formed in woody sapric material overlying sandy deposits. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Slope is 0 to 2 percent.

Typical pedon of Tawas mucky peat, 500 feet south and 400 feet east of the center of sec. 18, T. 23 N., R. 1 E., Foster Township:

- Oe—0 to 7 inches; black (5YR 2/1), broken face, dark reddish brown (5YR 2/2), rubbed, hemic material; about 50 percent fibers, 30 percent rubbed; weak medium granular structure; primarily woody material; medium acid; abrupt smooth boundary.
- Oa1—7 to 19 inches; black (10YR 2/1), broken face, black (5YR 2/1), rubbed, primarily sapric woody material; about 25 percent fibers, 5 percent rubbed; weak medium granular structure; slightly acid; clear smooth boundary.
- Oa2—19 to 28 inches; black (5YR 2/1), broken face and rubbed, primarily sapric woody material; about 30 percent fibers, 15 percent rubbed; weak coarse granular structure; slightly acid; clear smooth boundary.
- Oa3—28 to 31 inches; black (10YR 2/1), broken face and rubbed, primarily sapric woody material; about 25 percent fibers, 15 percent rubbed; massive breaking to coarse subangular fragments; neutral; abrupt smooth boundary.
- Cg1—31 to 40 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; mildly alkaline; clear wavy boundary.
- Cg2—40 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; moderately alkaline.

The depth to the C horizon ranges from 16 to 51 inches. The organic material is primarily woody. It has

hue of 5YR to 10YR, value of 2 or 3, and chroma of 0 to 2.

The surface tier is typically sapric, but the range includes hemic material. The subsurface and bottom tiers are dominantly sapric material, but they have thin layers of hemic material. The total thickness of these layers is less than 10 inches. The Cg horizon has value of 4 to 6 and chroma of 1 to 3. It is sand, loamy sand, or coarse sand.

Tonkey Series

The Tonkey series consists of poorly drained, moderately rapidly permeable soils on till plains and outwash plains. These soils formed in stratified sandy and loamy glaciofluvial deposits. Slope is 0 to 2 percent.

Typical pedon of Tonkey sandy loam, 100 feet west and 2,000 feet north of the southeast corner of sec. 24, T. 22 N., R. 4 E., Hill Township:

- A—0 to 7 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; many fine and medium roots; neutral; abrupt wavy boundary.
- Bg1—7 to 9 inches; grayish brown (10YR 5/2) loamy sand; weak medium subangular blocky structure; very friable; many fine and common medium roots; neutral; clear wavy boundary.
- Bg2—9 to 12 inches; light brownish gray (2.5Y 6/2) sandy loam; common medium prominent brownish yellow (10YR 6/8) mottles; weak medium subangular blocky structure; friable; common prominent very dark gray (10YR 3/1) organic stains; few fine and medium roots; neutral; clear wavy boundary.
- Bw—12 to 17 inches; light yellowish brown (10YR 6/4) sandy clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; firm; few prominent very dark gray (10YR 3/1) organic stains; few fine roots; neutral; abrupt wavy boundary.
- C—17 to 60 inches; light yellowish brown (10YR 6/4), pale brown (10YR 6/3), light brownish gray (10YR 6/2), and gray (10YR 6/1), stratified fine sand, very fine sand, loam, and silt loam; common medium prominent strong brown (7.5YR 5/6) and common fine distinct brownish yellow (10YR 6/6) mottles; massive; friable; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 16 to 30

inches. The content of gravel ranges from 0 to 5 percent in the solum.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loamy sand and loamy fine sand. The Bg horizon has hue of 2.5Y, 10YR, or 7.5YR, value of 5 or 6, and chroma of 1 or 2. It is sandy loam or loamy sand. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is sandy clay loam or loam. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 3. It is stratified with textures ranging from sand to silt loam. Texture is variable within short horizontal distances. Gravel lenses are in the C horizon in places.

Wheatley Series

The Wheatley series consists of poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy and gravelly glaciofluvial deposits. Slope is 0 to 2 percent.

Typical pedon of Wheatley mucky loamy sand, 2,508 feet north and 30 feet east of the southwest corner of sec. 31, T. 21 N., R. 2 E., Horton Township:

A—0 to 10 inches; black (N 2/0) mucky loamy sand; weak medium granular structure; very friable; many

fine and common medium roots; neutral; abrupt smooth boundary.

Cg1—10 to 30 inches; dark grayish brown (10YR 4/2) sand; common medium faint brown (10YR 5/3) mottles; single grain; loose; few fine roots; about 2 percent gravel; many distinct very dark gray (10YR 3/1) organic strains; mildly alkaline; clear wavy boundary.

Cg2—30 to 42 inches; dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; about 15 percent gravel; mildly alkaline; clear wavy boundary.

Cg3—42 to 50 inches; grayish brown (10YR 5/2) very gravelly sand; single grain; loose; about 40 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg4—50 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; about 10 percent gravel; strongly effervescent; moderately alkaline.

The depth to carbonates ranges from 20 to 42 inches. The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly mucky loamy sand, but the range includes loamy sand and sandy loam. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The content of gravel in this horizon is 2 to 60 percent.

Formation of the Soils

This section relates the factors of soil formation to the soils in Ogemaw County and explains the processes of soil formation.

Factors of Soil Formation

Soil formation is determined by the interaction of five major factors—the physical, chemical, and mineral composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material (4).

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and living organisms are modified by relief. The nature of the parent material affects the kind of soil profile that is formed. In extreme cases, it determines the soil profile entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is required for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the chemical and mineralogical composition of the soil. The parent material of the soils in Ogemaw County was deposited by glaciers or by meltwater from the glaciers that covered the county 10,000 to 12,000 years ago. Some of this material has been reworked and redeposited by the subsequent actions of water and wind. Although the parent material in the county is of common glacial origin, the properties vary greatly, sometimes within a

small area, depending on how the material was deposited. The dominant parent material in Ogemaw County was deposited as glacial till, outwash material, alluvium, and organic material.

Glacial till is deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Ogemaw County generally is calcareous sandy loam, loam, silty clay loam, clay loam, or clay. The Nester and Isabella soils are examples of soils that formed in glacial till. The soils that formed in this till typically are medium textured to moderately fine textured and have a well developed subsoil.

Outwash material is deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the speed of the stream decreased, the coarser particles were deposited first. Only the finer particles, such as the very fine sand, silt, and clay, could be carried by slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as sand, gravel, and other coarse particles. The Mancelona soils are an example of soils that formed in deposits of outwash material.

Alluvium is recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along a swift stream, such as the headwaters of the Rifle River, is coarser textured than that deposited by a slow, sluggish stream, such as the Rifle River. The Colonville and Evart soils are examples of soils that formed in alluvium.

Organic material is made up of accumulated plant remains. After the glaciers receded, water was left standing in depressions on outwash plains, flood plains, moraines, and till plains. Grasses, sedges, and water-tolerant plants grew around the edges of these lakes. When these plants died, their residue did not decompose because the areas were wet. Later, water-tolerant trees grew in the areas. As the trees died, their

residue became part of the organic accumulation. Eventually, the lakes were filled with organic material and developed into areas of muck. The Lupton soils are an example of soils that formed in organic material.

Plant and Animal Life

Green plants have been the principal organisms influencing the soils in Ogemaw County. Bacteria, fungi, earthworms, and human activities have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material in the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants created channels through which water moved into the soil. They also added organic matter as they decayed. Bacteria in the soil helped to break down the organic matter so that it could be used by growing plants.

The original vegetation in Ogemaw County was a mixture of deciduous and coniferous trees. Differences in natural soil drainage and minor variations in parent material affected the composition of the forest species. The well drained upland soils, such as the Klacking and Montcalm soils, were covered mainly by jack pine and white pine. The wet soils were covered mainly by elm, ash, aspen, and white cedar.

Climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for weathering minerals and for transporting soil material. Climate influences temperature, thus affecting the rate of chemical reaction in the soil.

The climate in Ogemaw County is cool and humid. It is presumably similar to that under which the soils formed. It is uniform throughout the county. Only minor differences among the soils are the result of differences in climate.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. In Ogemaw County, slopes range from 0 to 50 percent. Runoff is rapid on the steeper slopes. Water temporarily ponds in low areas.

The soils in Ogemaw County range from excessively drained on the sandy ridgetops to very poorly drained in the depressions. Through its effect on soil aeration,

drainage determines the color of the soil. Water and air move freely through the well drained soils and slowly through very poorly drained soils. In Rubicon and other soils that are excessively drained to well drained and well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. Roscommon and other soils that are poorly drained and poorly aerated are dull gray and mottled. The Rubicon and Roscommon soils formed in similar kinds of parent material.

Time

Generally, a long time is required for the development of distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected by the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Ogemaw County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the development of distinct horizons. The recent alluvium in which the younger soils formed, however, has not been in place long enough for distinct horizons to develop.

The Evart soils, which formed in alluvial material, are an example of young soils. The mature Nester soils are old enough for distinct horizons to have formed and for lime to have moved from the upper layers to the lower layers.

Processes of Soil Formation

The processes responsible for the formation of a soil in the unconsolidated parent material are referred to collectively as soil genesis. The physical, chemical, and biological properties of the horizons are known as soil morphology.

Several processes were involved in the development of horizons in the soils of Ogemaw County. These are the accumulation of organic matter, the leaching of lime and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils in the county, more than one of these processes has been active in the development of horizons.

As organic matter accumulates on the surface of a soil, the uppermost, or A, horizon is formed. If the soil is plowed, the A horizon is mixed into a plow layer, or Ap horizon. In the soils in Ogemaw County, the organic matter content of the surface layer ranges from high to

low. The Evert soils, for example, have a high content of organic matter in the surface layer, and the Grayling soils have a low content of organic matter.

In most of the soils of Ogemaw County, leaching of carbonates and other bases from the surface layer has occurred. The leaching of bases generally precedes the translocation of silicate clay minerals. Several of the soils in the county are moderately leached to strongly leached. For example, the Au Gres and Graycalm soils are leached of carbonates to a depth of more than 60 inches, whereas the Kent soils are leached to a depth of about 23 inches. This difference in the depth of leaching is a result of differences in time, relief, and parent material.

Gleying, or the reduction and transfer of iron, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. A gray subsoil indicates the reduction and loss of iron. The Sims soils are an

example of strongly gleyed soils.

The translocation of clay minerals contributes to horizon development. The eluviated, or leached, E horizon typically is lower in clay content and lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay or clay films in pores and on the faces of peds. Soils at this stage of formation probably were leached of carbonates and soluble salts to a considerable extent before the translocation of silicate clays. The Kent soils are an example of soils in which translocated silicate clay in the form of clay films has accumulated in the B horizon.

In some soils iron, aluminum, and humus have moved from the surface layer to the B horizon. As a result, the B horizon in such soils is brown. The Croswell, Au Gres, and Iosco soils are examples of soils in which translocated iron, aluminum, and humus have accumulated in the B horizon.

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Glossary

AC soil. A soil having only an A and a C horizon.

Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High.....	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural

class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form

a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious.

Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another

within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential.

They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Marl. Soft and unconsolidated calcium carbonate, usually mixed with varying amounts of clay or other impurities.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon,

hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil

is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes in this county are—

Nearly level.....	0 to 3 percent
Undulating.....	2 to 6 percent
Gently rolling.....	6 to 12 percent
Rolling.....	12 to 18 percent
Hilly.....	18 to 25 percent
Steep.....	25 to 35 percent
Very steep.....	more than 35 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand.....	2.0 to 1.0
Coarse sand.....	1.0 to 0.5
Medium sand.....	0.5 to 0.25
Fine sand.....	0.25 to 0.10
Very fine sand.....	0.10 to 0.05
Silt.....	0.05 to 0.002
Clay.....	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of

the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff

so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION
(Recorded in the period 1951-80 at West Branch and Lupton, Michigan)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In		In
WEST BRANCH:											
January---	26.3	9.3	17.8	46	-18	0	1.43	0.8	2.0	4	15.0
February---	29.4	10.0	19.7	48	-18	0	1.32	.7	1.9	4	11.6
March-----	38.8	18.9	28.8	65	-10	2	1.88	1.1	2.6	5	9.7
April-----	54.4	31.2	42.8	82	10	44	2.44	1.6	3.2	6	2.5
May-----	67.5	41.0	54.3	88	22	197	2.78	1.6	3.8	6	**
June-----	76.5	50.6	63.6	93	32	416	2.80	1.4	4.0	6	.0
July-----	80.6	55.0	67.8	94	39	559	3.25	1.8	4.6	6	.0
August-----	78.1	53.6	65.9	93	37	500	3.10	1.8	4.3	6	.0
September---	69.4	46.4	57.9	89	28	261	3.04	1.6	4.4	7	.0
October---	58.5	36.9	47.7	80	18	85	2.48	1.2	3.6	6	.2
November---	43.4	27.1	35.2	67	2	8	2.45	1.6	3.2	6	5.6
December---	31.0	15.6	23.3	55	-11	0	1.90	1.0	2.7	5	12.7
Year-----	54.5	33.0	43.7	96	-20	2,072	28.87	25.2	32.3	67	57.3
LUPTON:											
January---	27.3	6.3	16.8	48	-27	0	1.44	0.8	2.0	4	14.7
February---	30.7	6.3	18.5	50	-25	0	1.24	.7	1.8	4	10.8
March-----	40.3	16.0	28.1	65	-19	1	1.93	1.2	2.6	5	10.2
April-----	56.1	28.7	42.4	83	7	40	2.53	1.8	3.2	7	2.7
May-----	69.3	37.9	53.6	90	20	182	2.97	1.7	4.1	6	.1
June-----	78.3	47.0	62.6	94	28	389	2.82	1.5	4.0	7	.0
July-----	82.2	50.5	66.4	95	34	515	3.32	1.9	4.6	6	.0
August-----	79.8	49.1	64.5	94	31	456	3.29	1.7	4.7	6	.0
September---	71.2	42.6	56.9	90	23	238	3.12	1.7	4.4	6	.0
October---	60.0	33.5	46.7	83	14	72	2.31	1.1	3.3	6	.4
November---	44.2	25.5	34.9	68	-1	6	2.39	1.6	3.1	6	6.0
December---	31.6	13.8	22.7	56	-19	0	1.90	1.0	2.7	6	12.3
Year-----	55.9	29.8	42.8	97	-28	1,899	29.26	26.3	32.0	69	57.2

* A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

** Average is greater than zero but less than 0.1 inch snow.

TABLE 2.--FREEZE DATES IN SPRING AND FALL
(Recorded in the period 1930-79 at West Branch, Michigan)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 17	May 29	June 10
2 years in 10 later than--	May 11	May 24	June 5
5 years in 10 later than--	Apr. 30	May 15	May 26
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 30	Sept. 18	Sept. 3
2 years in 10 earlier than--	Oct. 5	Sept. 23	Sept. 9
5 years in 10 earlier than--	Oct. 17	Oct. 4	Sept. 21

TABLE 3.--GROWING SEASON
(Recorded in the period 1930-79 at West Branch,
Michigan)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
9 years in 10	142	119	90
8 years in 10	151	127	99
5 years in 10	169	142	117
2 years in 10	187	157	135
1 year in 10	197	164	144

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10B	Grayling sand, 0 to 6 percent slopes-----	11,645	3.2
10C	Grayling sand, 6 to 18 percent slopes-----	2,033	0.6
10E	Grayling sand, 18 to 35 percent slopes-----	219	0.1
11B	Rubicon sand, 0 to 6 percent slopes-----	11,150	3.0
11C	Rubicon sand, 6 to 18 percent slopes-----	4,311	1.2
11E	Rubicon sand, 18 to 35 percent slopes-----	1,901	0.5
11F	Rubicon sand, 35 to 50 percent slopes-----	587	0.2
12B	Croswell sand, 0 to 4 percent slopes-----	13,971	3.7
13A	Au Gres sand, 0 to 3 percent slopes-----	5,532	1.5
14	Roscommon mucky sand-----	5,916	1.6
17B	Graycalm sand, 0 to 6 percent slopes-----	41,715	11.3
17C	Graycalm sand, 6 to 18 percent slopes-----	10,578	2.9
17E	Graycalm sand, 18 to 35 percent slopes-----	4,003	1.1
18B	Klackling sand, 0 to 6 percent slopes-----	5,185	1.4
18C	Klackling sand, 6 to 18 percent slopes-----	4,544	1.2
18E	Klackling sand, 18 to 35 percent slopes-----	1,182	0.3
20B	Montcalm loamy sand, 0 to 6 percent slopes-----	6,763	1.8
20C	Montcalm loamy sand, 6 to 18 percent slopes-----	6,457	1.8
20E	Montcalm loamy sand, 18 to 35 percent slopes-----	2,978	0.8
21	Histosols and Aquents, ponded-----	6,180	1.7
22B	Nester fine sandy loam, 2 to 6 percent slopes-----	19,631	5.4
22B2	Nester loam, 2 to 6 percent slopes, eroded-----	2,615	0.7
22C	Nester fine sandy loam, 6 to 12 percent slopes-----	5,948	1.6
22C2	Nester loam, 6 to 12 percent slopes, eroded-----	5,539	1.5
22D	Nester fine sandy loam, 12 to 18 percent slopes-----	1,887	0.5
22D2	Nester loam, 12 to 18 percent slopes, eroded-----	575	0.2
22D3	Nester clay loam, 12 to 25 percent slopes, severely eroded-----	255	0.1
22E	Nester fine sandy loam, 18 to 35 percent slopes-----	1,911	0.5
22F	Nester fine sandy loam, 35 to 50 percent slopes-----	403	0.1
23B	Kawkawlin loam, 0 to 4 percent slopes-----	12,168	3.3
24	Sims loam-----	4,655	1.3
25B	Kent sandy loam, 2 to 6 percent slopes-----	6,878	1.9
25B2	Kent loam, 2 to 6 percent slopes, eroded-----	1,689	0.5
25C	Kent sandy loam, 6 to 12 percent slopes-----	576	0.2
25C2	Kent loam, 6 to 12 percent slopes, eroded-----	506	0.1
25D	Kent sandy loam, 12 to 18 percent slopes-----	134	*
26B	Selkirk loam, 0 to 4 percent slopes-----	10,258	2.8
27	Pickford silty clay loam-----	1,786	0.5
28	Udorthents, loamy, nearly level-----	305	0.1
29	Udipsamments, nearly level-----	411	0.1
30B	Isabella loamy sand, 2 to 6 percent slopes-----	2,054	0.6
30C	Isabella loamy sand, 6 to 12 percent slopes-----	3,051	0.8
30D	Isabella loamy sand, 12 to 18 percent slopes-----	1,119	0.3
30E	Isabella loamy sand, 18 to 35 percent slopes-----	392	0.1
32	Angelica loam-----	1,044	0.3
36B	Alcona loamy fine sand, 2 to 6 percent slopes-----	764	0.2
37A	Ingalls sand, 0 to 3 percent slopes-----	1,520	0.4
38	Tonkey sandy loam-----	738	0.2
39	Pits, gravel-----	348	0.1
42C	Nester-Mancelona complex, 6 to 12 percent slopes-----	513	0.1
43B	East Lake sand, 0 to 6 percent slopes-----	2,029	0.6
44B	Croswell sand, loamy substratum, 0 to 3 percent slopes-----	3,014	0.8
45	Wheatley mucky loamy sand-----	3,151	0.9
46B	Mancelona sand, 0 to 6 percent slopes-----	8,576	2.3
46C	Mancelona sand, 6 to 18 percent slopes-----	2,296	0.6
46E	Mancelona sand, 18 to 35 percent slopes-----	860	0.2
46F	Mancelona sand, 35 to 50 percent slopes-----	5,252	1.4
47A	Gladwin sand, 0 to 3 percent slopes-----	5,252	1.4
48	Epoufette mucky sand-----	1,077	0.3
49A	Colonville silt loam, 0 to 3 percent slopes-----	1,160	0.3
50B	Menominee sand, 0 to 6 percent slopes-----	5,583	1.5
50C	Menominee sand, 6 to 12 percent slopes-----	3,211	0.9
50D	Menominee sand, 12 to 18 percent slopes-----	6,030	1.6

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
50E	Menominee sand, 18 to 35 percent slopes-----	749	0.2
51B	Iosco sand, 0 to 4 percent slopes-----	5,805	1.6
52	Brevort mucky loamy sand-----	3,559	1.0
53B	Manistee loamy sand, 0 to 6 percent slopes-----	3,888	1.1
53C	Manistee loamy sand, 6 to 12 percent slopes-----	1,033	0.3
53D	Manistee loamy sand, 12 to 18 percent slopes-----	335	0.1
54B	Allendale loamy sand, 0 to 4 percent slopes-----	3,120	0.8
57A	Belding sandy loam, 0 to 3 percent slopes-----	1,383	0.4
63	Evart sand-----	2,034	0.6
64B	Melita sand, 0 to 6 percent slopes-----	1,504	0.4
64C	Melita sand, 6 to 18 percent slopes-----	426	0.1
65	Arnheim silt loam-----	500	0.1
70	Loxley peat-----	1,249	0.3
71	Dawson peat-----	440	0.1
74	Cathro muck-----	1,978	0.5
76	Lupton muck-----	20,069	5.5
77	Tawas mucky peat-----	9,333	2.5
78	Rondeau muck-----	1,013	0.3
79	Grousehaven muck-----	624	0.2
82B	Nester-Manistee complex, 2 to 6 percent slopes-----	3,052	0.8
82C	Nester-Manistee complex, 6 to 12 percent slopes-----	2,171	0.6
82D	Nester-Manistee complex, 12 to 18 percent slopes-----	860	0.2
82E	Nester-Manistee complex, 18 to 35 percent slopes-----	464	0.1
83B	Rubicon-Menominee sands, 0 to 6 percent slopes-----	702	0.2
83C	Rubicon-Menominee sands, 6 to 18 percent slopes-----	1,977	0.5
83E	Rubicon-Menominee sands, 18 to 35 percent slopes-----	611	0.2
85B	Kent-Selkirk complex, 0 to 6 percent slopes-----	897	0.2
86C	Nester-Graycalm complex, 6 to 12 percent slopes-----	610	0.2
86D	Nester-Graycalm complex, 12 to 18 percent slopes-----	219	0.1
86E	Nester-Graycalm complex, 18 to 35 percent slopes-----	184	*
87C	Isabella-Melita complex, burned, 6 to 18 percent slopes-----	274	0.1
87E	Isabella-Melita complex, burned, 18 to 40 percent slopes-----	107	*
90C	Rubicon-Montcalm complex, 6 to 18 percent slopes-----	420	0.1
93C	Klacking-Isabella complex, 6 to 12 percent slopes-----	612	0.2
93D	Klacking-Isabella complex, 12 to 18 percent slopes-----	1,185	0.3
93E	Klacking-Isabella complex, 18 to 25 percent slopes-----	662	0.2
94B	Isabella-Montcalm loamy sands, 0 to 6 percent slopes-----	214	0.1
94C	Isabella-Montcalm loamy sands, 6 to 18 percent slopes-----	1,536	0.4
94E	Isabella-Montcalm loamy sands, 18 to 25 percent slopes-----	796	0.2
97B	Isabella-Melita complex, 0 to 6 percent slopes-----	377	0.1
97C	Isabella-Melita complex, 6 to 18 percent slopes-----	849	0.2
	Water areas less than 40 acres in size-----	2,709	0.7
	Water areas more than 40 acres in size-----	3,520	1.0
	Total-----	368,064	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
22B	Nester fine sandy loam, 2 to 6 percent slopes
22B2	Nester loam, 2 to 6 percent slopes, eroded
23B	Kawkawlin loam, 0 to 4 percent slopes (where drained)
24	Sims loam (where drained)
25B	Kent sandy loam, 2 to 6 percent slopes
25B2	Kent loam, 2 to 6 percent slopes, eroded
26B	Selkirk loam, 0 to 4 percent slopes (where drained)
30B	Isabella loamy sand, 2 to 6 percent slopes
32	Angelica loam (where drained)
36B	Alcona loamy fine sand, 2 to 6 percent slopes
38	Tonkey sandy loam (where drained)
52	Brevort mucky loamy sand (where drained)
57A	Belding sandy loam, 0 to 3 percent slopes (where drained)
82B	Nester-Manistee complex, 2 to 6 percent slopes
85B	Kent-Selkirk complex, 0 to 6 percent slopes
94B	Isabella-Montcalm loamy sands, 0 to 6 percent slopes
97B	Isabella-Melita complex, 0 to 6 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat	Alfalfa hay	Soybeans	Sugar beets
		<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Tons</u>
10B----- Grayling	VIIs	---	---	---	---	---	---	---
10C, 10E----- Grayling	VIIIs	---	---	---	---	---	---	---
11B----- Rubicon	VIIs	---	---	---	---	2.0	---	---
11C, 11E, 11F--- Rubicon	VIIIs	---	---	---	---	---	---	---
12B----- Croswell	IVs	50	9	40	25	2.5	---	---
13A----- Au Gres	IVw	55	10	45	25	---	---	---
14----- Roscommon	VIw	---	---	---	---	---	---	---
17B----- Graycalm	IVs	50	9	40	25	2.5	---	---
17C----- Graycalm	VIIs	---	---	---	---	2.3	---	---
17E----- Graycalm	VIIIs	---	---	---	---	---	---	---
18B----- Klacking	IIIIs	---	11	60	---	3.0	---	---
18C----- Klacking	IVe	---	8	45	---	2.0	---	---
18E----- Klacking	VIIe	---	---	---	---	---	---	---
20B----- Montcalm	IIIIs	70	12	60	28	3.0	---	---
20C----- Montcalm	IVe	---	---	---	---	2.5	---	---
20E----- Montcalm	VIIe	---	---	---	---	---	---	---
21----- Histosols and Aquents	VIIIw	---	---	---	---	---	---	---
22B----- Nester	IIe	90	15	80	45	4.0	35	18
22B2----- Nester	IIe	80	14	75	40	3.7	30	18

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat	Alfalfa hay	Soybeans	Sugar beets
		<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Tons</u>
22C----- Nester	IIIe	80	14	80	40	3.8	28	---
22C2----- Nester	IIIe	75	13	75	40	3.1	24	---
22D----- Nester	IVe	75	13	75	40	3.2	18	---
22D2----- Nester	IVe	55	10	60	30	2.7	16	---
22D3----- Nester	VIe	---	---	---	---	2.3	---	---
22E, 22F----- Nester	VIIe	---	---	---	---	2.7	---	---
23B----- Kawkawlin	IIe	95	18	90	45	4.5	35	20
24----- Sims	IIw	100	18	100	47	---	---	21
25B----- Kent	IIIe	90	15	90	40	4.0	25	19
25B2----- Kent	IIIe	80	12	80	35	3.5	22	19
25C----- Kent	IIIe	75	13	70	35	3.7	20	---
25C2----- Kent	IIIe	75	12	80	35	3.0	---	---
25D----- Kent	IVe	60	8	50	25	2.5	---	---
26B----- Selkirk	IIIe	95	16	90	43	4.0	---	19
27----- Pickford	IIIw	90	---	90	---	---	---	---
28. Udorthents								
29. Udipsamments								
30B----- Isabella	IIe	90	15	80	45	4.0	---	---
30C----- Isabella	IIIe	85	14	75	43	3.8	---	---
30D----- Isabella	IVe	80	12	65	40	3.3	---	---
30E----- Isabella	VIIe	---	---	---	---	---	---	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat	Alfalfa hay	Soybeans	Sugar beets
		<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Tons</u>
32----- Angelica	IIw	100	16	90	---	4.5	---	---
36B----- Alcona	IIe	85	13	75	35	3.5	---	---
37A----- Ingalls	IIIw	85	14	75	40	3.5	---	---
38----- Tonkey	Vw	---	---	---	---	---	---	---
39*. Pits								
42C----- Nester- Mancelona	IIIe	75	13	75	40	3.6	24	---
43B----- East Lake	IVs	50	9	40	---	2.5	---	---
44B----- Croswell	IVs	---	---	50	---	2.5	---	---
45----- Wheatley	Vw	---	---	---	---	---	---	---
46B----- Mancelona	IIIs	65	11	55	24	2.6	---	---
46C----- Mancelona	IVe	---	---	45	20	2.2	---	---
46E, 46F----- Mancelona	VIIe	---	---	---	---	---	---	---
47A----- Gladwin	IIIw	70	12	65	35	3.0	23	---
48----- Epoufette	Vw	---	---	---	---	---	---	---
49A----- Colonville	Vw	---	---	---	---	---	---	---
50B----- Menominee	IIIs	75	13	70	35	3.5	---	---
50C----- Menominee	IIIe	65	12	65	30	3.3	---	---
50D----- Menominee	IVe	---	---	55	23	3.1	---	---
50E----- Menominee	VIIe	---	---	---	---	---	---	---
51B----- Iosco	IIIw	85	15	75	40	3.5	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat	Alfalfa hay	Soybeans	Sugar beets
		<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Tons</u>
52----- Brevort	Vw	---	---	---	---	---	---	---
53B----- Manistee	IIIIs	75	12	70	35	3.5	---	---
53C----- Manistee	IIIe	65	12	65	30	3.2	---	---
53D----- Manistee	IVe	---	---	---	---	3.0	---	---
54B----- Allendale	IIIw	70	11	65	40	3.5	---	---
57A----- Belding	IIw	90	15	85	45	4.0	---	---
63----- Ewart	VIIw	---	---	---	---	---	---	---
64B----- Melita	IVs	50	9	40	25	2.5	---	---
64C----- Melita	VIIs	---	---	---	---	---	---	---
65----- Arnhem	Vw	---	---	---	---	---	---	---
70----- Loxley	VIIw	---	---	---	---	---	---	---
71----- Dawson	VIIw	---	---	---	---	---	---	---
74----- Cathro	VIw	---	---	---	---	---	---	---
76----- Lupton	VIw	---	---	---	---	---	---	---
77----- Tawas	VIw	---	---	---	---	---	---	---
78----- Rondeau	VIw	---	---	---	---	---	---	---
79----- Grousehaven	VIIw	---	---	---	---	---	---	---
82B----- Nester-Manistee	IIe	78	13	73	37	3.6	---	---
82C----- Nester-Manistee	IIIe	68	12	68	33	3.4	---	---
82D----- Nester-Manistee	IVe	---	---	---	---	3.0	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat	Alfalfa hay	Soybeans	Sugar beets
		<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Tons</u>
82E----- Nester-Manistee	VIIe	---	---	---	---	---	---	---
83B----- Rubicon- Menominee	VIIs	---	---	---	---	2.6	---	---
83C----- Rubicon- Menominee	VIIIs	---	---	---	---	2.2	---	---
83E----- Rubicon- Menominee	VIIIs	---	---	---	---	---	---	---
85B----- Kent-Selkirk	IIIe	80	15	75	35	3.5	---	---
86C----- Nester-Graycalm	IIIe	---	---	---	---	3.1	---	---
86D----- Nester-Graycalm	IVe	---	---	---	---	2.9	---	---
86E----- Nester-Graycalm	VIIe	---	---	---	---	---	---	---
87C----- Isabella-Melita	IVe	---	---	---	---	---	---	---
87E----- Isabella-Melita	VIIe	---	---	---	---	---	---	---
90C----- Rubicon- Montcalm	VIIIs	---	---	---	---	---	---	---
93C----- Klacking- Isabella	IIIe	---	---	---	---	---	---	---
93D----- Klacking- Isabella	IVe	---	---	---	---	---	---	---
93E----- Klacking- Isabella	VIe	---	---	---	---	---	---	---
94B----- Isabella- Montcalm	IIe	---	---	---	---	---	---	---
94C----- Isabella- Montcalm	IVe	---	---	---	---	---	---	---
94E----- Isabella- Montcalm	VIe	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat	Alfalfa hay	Soybeans	Sugar beets
		<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Bu</u>	<u>Tons</u>
97B----- Isabella-Melita	Ile	---	---	---	---	---	---	---
97C----- Isabella-Melita	IVe	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e) <u>Acres</u>	Wetness (w) <u>Acres</u>	Soil problem (s) <u>Acres</u>
I	---	---	---	---
II	47,957	40,875	7,082	---
III	90,970	43,492	17,483	29,995
IV	82,104	28,310	5,532	48,262
V	10,185	---	10,185	---
VI	88,494	1,713	38,309	48,472
VII	34,891	14,482	4,347	16,062
VIII	6,180	---	6,180	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
10B, 10C----- Grayling	4S	Slight	Moderate	Moderate	Slight	Jack pine----- Northern pin oak--- White oak----- Red pine----- Quaking aspen-----	48 43 --- --- ---	63 25 --- --- ---	Jack pine, red pine.
10E----- Grayling	4R	Moderate	Moderate	Moderate	Slight	Jack pine----- Northern pin oak--- White oak----- Red pine----- Quaking aspen-----	48 43 --- --- ---	63 25 --- --- ---	Jack pine, red pine.
11B, 11C----- Rubicon	4S	Slight	Moderate	Moderate	Slight	Quaking aspen----- Jack pine----- Red pine----- Bigtooth aspen----- Northern red oak--- Red maple----- Paper birch----- Eastern white pine-- White oak-----	60 53 50 --- 55 --- --- 45 50	64 73 75 --- 42 --- --- 75 34	Red pine, jack pine.
11E----- Rubicon	4R	Moderate	Moderate	Moderate	Slight	Quaking aspen----- Jack pine----- Red pine----- Bigtooth aspen----- Northern red oak--- Red maple----- Paper birch----- Eastern white pine-- White oak-----	60 53 50 --- 55 --- --- 45 50	64 73 75 --- 42 --- --- 75 34	Red pine, jack pine.
11F----- Rubicon	4R	Severe	Severe	Moderate	Slight	Quaking aspen----- Jack pine----- Red pine----- Bigtooth aspen----- Northern red oak--- Red maple----- Paper birch----- Eastern white pine-- White oak-----	60 53 50 --- 55 --- --- 45 50	64 85 75 --- 42 --- --- 75 34	Red pine, jack pine.
12B----- Croswell	5S	Slight	Moderate	Moderate	Moderate	Quaking aspen----- Red pine----- Jack pine----- Northern red oak--- Black cherry----- Eastern white pine-- Bigtooth aspen----- Red maple-----	68 55 53 --- --- --- --- ---	78 88 73 --- --- --- --- ---	Red pine, eastern white pine, white spruce.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
13A----- Au Gres	6W	Slight	Severe	Moderate	Severe	Quaking aspen----- Bigtooth aspen----- Balsam fir----- Paper birch----- Yellow birch----- Red maple----- Eastern hemlock----- Eastern white pine----- Northern whitecedar-----	70 --- --- --- --- --- --- --- ---	81 --- --- --- --- --- --- --- ---	White spruce, red pine, eastern white pine, Norway spruce.
14----- Roscommon	6W	Slight	Severe	Severe	Severe	Quaking aspen----- Black spruce----- Northern whitecedar----- Jack pine----- Balsam fir----- Red maple----- Yellow birch-----	74 --- --- --- --- --- ---	86 --- --- --- --- --- ---	
17B, 17C----- Graycalm	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen----- Northern red oak----- Jack pine----- Red pine----- Paper birch----- Eastern white pine----- American beech-----	70 --- 56 64 --- --- ---	81 --- 78 112 --- --- ---	Red pine, eastern white pine.
17E----- Graycalm	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen----- Northern red oak----- Jack pine----- Red pine----- Paper birch----- Eastern white pine----- American beech-----	70 --- 56 64 --- --- ---	81 --- 78 112 --- --- ---	Red pine, eastern white pine.
18B, 18C----- Klackang	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen----- White oak----- Northern red oak----- Red maple----- Black cherry-----	70 55 60 --- ---	81 42 51 --- ---	Eastern white pine, red pine.
18E----- Klackang	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen----- White oak----- Northern red oak----- Red maple----- Black cherry-----	70 55 60 --- ---	81 42 51 --- ---	Eastern white pine, red pine.
20B, 20C----- Montcalm	3A	Slight	Slight	Slight	Slight	Sugar maple----- Yellow birch----- Northern red oak----- Eastern white pine----- Red pine----- White oak-----	61 --- 66 --- --- 65	38 --- 60 --- --- 59	Red pine, eastern white pine, white spruce.
20E----- Montcalm	3R	Moderate	Moderate	Slight	Slight	Sugar maple----- Yellow birch----- Northern red oak----- Eastern white pine----- Red pine----- White oak-----	61 --- 66 --- --- 65	38 --- 60 --- --- 59	Red pine, eastern white pine, white spruce.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
22B, 22B2, 22C, 22C2, 22D, 22D2----- Nester	3L	Slight	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak---- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
22E----- Nester	3R	Moderate	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak---- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
22F----- Nester	3R	Severe	Severe	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak---- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
23B----- Kawkawlin	3W	Slight	Severe	Slight	Moderate	Red maple----- Northern red oak---- Swamp white oak---- White ash----- American basswood--- Quaking aspen----- Bigtooth aspen-----	61 --- --- --- --- --- ---	38 --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
24----- Sims	2W	Slight	Severe	Severe	Severe	Red maple----- White ash----- American basswood--- Black spruce----- Quaking aspen----- Northern whitecedar- Balsam fir----- Bigtooth aspen-----	45 --- --- --- --- --- --- ---	27 --- --- --- --- --- --- ---	
25B, 25B2, 25C, 25C2, 25D----- Kent	8C	Slight	Severe	Slight	Slight	White spruce----- Balsam fir----- American basswood--- Eastern hemlock----- Quaking aspen----- Sugar maple----- Eastern white pine--- American beech----- American elm-----	54 54 55 --- --- --- --- --- ---	105 105 42 --- --- --- --- --- ---	White spruce, eastern white pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
26B----- Selkirk	2C	Slight	Severe	Moderate	Severe	Red maple-----	45	27	White spruce, eastern white pine, northern whitecedar.
						White spruce-----	45	84	
						Eastern hemlock-----	---	---	
						Balsam fir-----	45	83	
						Quaking aspen-----	---	---	
27----- Pickford	6W	Slight	Severe	Severe	Severe	White spruce-----	45	84	
						Balsam fir-----	45	83	
						Paper birch-----	---	---	
						Eastern hemlock-----	---	---	
						Quaking aspen-----	---	---	
						Northern whitecedar-----	---	---	
30B, 30C, 30D--- Isabella	3L	Slight	Moderate	Slight	Slight	Sugar maple-----	61	38	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine---	---	---	
						American beech-----	---	---	
						White oak-----	---	---	
30E----- Isabella	3R	Moderate	Moderate	Slight	Slight	Sugar maple-----	61	38	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine---	---	---	
						American beech-----	---	---	
						White oak-----	---	---	
32----- Angelica	7W	Slight	Severe	Severe	Severe	Balsam fir-----	54	105	
						Quaking aspen-----	60	64	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						Northern whitecedar-----	---	---	
						Black ash-----	---	---	
36B----- Alcona	3L	Slight	Moderate	Slight	Slight	Sugar maple-----	61	38	White spruce, red pine, eastern white pine.
						Red maple-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						American beech-----	---	---	
						Northern red oak---	---	---	
						Eastern white pine---	---	---	
						White ash-----	---	---	
37A----- Ingalls	4W	Slight	Severe	Moderate	Severe	Red pine-----	---	---	Eastern white pine, white spruce.
						Quaking aspen-----	60	64	
						White ash-----	---	---	
						Red maple-----	---	---	
						Jack pine-----	---	---	
						Northern pin oak---	---	---	
						Northern whitecedar-----	---	---	
						Balsam fir-----	---	---	
						Paper birch-----	---	---	
						Red maple-----	---	---	
						Bigtooth aspen-----	---	---	
						Eastern hemlock-----	---	---	
						Yellow birch-----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
38----- Tonkey	5W	Slight	Severe	Severe	Severe	Quaking aspen-----	61	66	
						American basswood---	55	42	
						Balsam fir-----	---	---	
						Northern whitecedar-	---	---	
						Swamp white oak-----	---	---	
						American elm-----	---	---	
						Red maple-----	---	---	
42C**: Nester-----	3L	Slight	Moderate	Slight	Slight	Sugar maple-----	61	38	White spruce, red pine, Norway spruce, eastern white pine.
						Quaking aspen-----	---	---	
						White ash-----	---	---	
						American basswood---	---	---	
						Northern red oak---	---	---	
						White oak-----	---	---	
						Black cherry-----	---	---	
Mancelona-----	3S	Slight	Moderate	Moderate	Slight	American beech-----	---	---	
						Sugar maple-----	58	37	Red pine, eastern white pine.
						Northern red oak---	---	---	
						Red pine-----	---	---	
						Jack pine-----	---	---	
						Eastern white pine--	---	---	
						Yellow birch-----	---	---	
43B----- East Lake	2S	Slight	Moderate	Moderate	Slight	Red maple-----	53	34	Red pine, jack pine, eastern white pine.
						Northern red oak---	---	---	
						Quaking aspen-----	---	---	
						Red pine-----	55	88	
						Jack pine-----	---	---	
44B----- Croswell	7S	Slight	Moderate	Moderate	Slight	Paper birch-----	---	---	Red pine, eastern white pine, jack pine.
						Red pine-----	60	101	
						Jack pine-----	---	---	
						Eastern white pine--	---	---	
						Northern pin oak---	---	---	
						Quaking aspen-----	---	---	
						Bigtooth aspen-----	---	---	
45----- Wheatley	2W	Slight	Severe	Severe	Severe	Northern red oak---	---	---	
						Quaking aspen-----	45	32	
						Balsam fir-----	40	71	
						Northern whitecedar-	15	26	
						Black spruce-----	15	23	
						Red maple-----	40	22	
46B, 46C----- Mancelona	5S	Slight	Moderate	Moderate	Slight	Eastern hemlock-----	---	---	Red pine, eastern white pine.
						Quaking aspen-----	66	75	
						Northern red oak---	---	---	
						Red pine-----	---	---	
						Jack pine-----	---	---	
						Eastern white pine--	---	---	
46E----- Mancelona	5R	Moderate	Moderate	Moderate	Slight	Yellow birch-----	---	---	Red pine, eastern white pine.
						Quaking aspen-----	66	75	
						Northern red oak---	---	---	
						Red pine-----	---	---	
						Jack pine-----	---	---	
						Eastern white pine--	---	---	
						Yellow birch-----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
46F----- Mancelona	5R	Severe	Severe	Moderate	Slight	Quaking aspen-----	66	75	Red pine, eastern white pine.
						Northern red oak----	---	---	
						Red pine-----	---	---	
						Jack pine-----	---	---	
						Eastern white pine--	---	---	
						Yellow birch-----	---	---	
47A----- Gladwin	4W	Slight	Severe	Moderate	Severe	Quaking aspen-----	60	64	White spruce, eastern white pine.
						Eastern hemlock-----	---	---	
						Eastern white pine--	53	99	
						Red maple-----	56	36	
						Bigtooth aspen-----	60	64	
						Balsam fir-----	53	102	
						Paper birch-----	55	57	
						White spruce-----	53	103	
48----- Epoufette	2W	Slight	Severe	Severe	Severe	Quaking aspen-----	45	32	
						Black spruce-----	46	59	
						Northern whitecedar--	---	---	
						Red maple-----	42	24	
						Yellow birch-----	---	---	
						Balsam fir-----	---	---	
49A----- Colonville	3W	Slight	Severe	Slight	Moderate	Red maple-----	61	38	White spruce, northern red oak, eastern white pine, northern whitecedar, Norway spruce.
						Swamp white oak----	66	60	
						American basswood---	65	59	
						Northern whitecedar--	45	67	
						White ash-----	65	59	
						Balsam fir-----	61	120	
						Quaking aspen-----	---	---	
50B, 50C, 50D--- Menominee	6S	Slight	Moderate	Moderate	Slight	Quaking aspen-----	74	86	Red pine, white spruce, eastern white pine.
						Red pine-----	---	---	
						Black cherry-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
50E----- Menominee	6R	Moderate	Moderate	Moderate	Slight	Quaking aspen-----	74	86	Red pine, white spruce, eastern white pine.
						Red pine-----	---	---	
						Black cherry-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
51B----- Iosco	4W	Slight	Severe	Moderate	Severe	Quaking aspen-----	60	64	White spruce, eastern white pine.
						White ash-----	---	---	
						Red maple-----	---	---	
						Yellow birch-----	---	---	
						Northern pin oak----	---	---	
						Eastern white pine--	---	---	
52----- Brevort	2W	Slight	Severe	Severe	Severe	Quaking aspen-----	40	22	
						Balsam fir-----	---	---	
						Northern whitecedar--	---	---	
						American basswood---	---	---	
						Red maple-----	---	---	
						Black spruce-----	15	23	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
53B, 53C----- Manistee	6A	Slight	Slight	Slight	Slight	Quaking aspen-----	70	81	Red pine, eastern white pine.
						Eastern white pine--	---	---	
						Red maple-----	---	---	
						Red pine-----	---	---	
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	---	---	
53D----- Manistee	6A	Moderate	Moderate	Slight	Slight	Quaking aspen-----	70	81	Red pine, eastern white pine.
						Eastern white pine--	---	---	
						Red maple-----	---	---	
						Red pine-----	---	---	
						American basswood---	---	---	
						Eastern hemlock-----	---	---	
						Northern red oak----	---	---	
54B----- Allendale	4W	Slight	Severe	Slight	Moderate	Quaking aspen-----	60	64	White spruce, eastern white pine.
						White ash-----	---	---	
						Eastern white pine--	---	---	
						White spruce-----	---	---	
						Paper birch-----	---	---	
						Balsam fir-----	---	---	
						Red maple-----	---	---	
57A----- Belding	4W	Slight	Severe	Moderate	Severe	Quaking aspen-----	60	64	White spruce, eastern white pine.
						Black ash-----	---	---	
						Red maple-----	55	35	
						American basswood---	55	42	
						Swamp white oak----	---	---	
						Northern red oak----	55	42	
						White ash-----	---	---	
						American elm-----	---	---	
63----- Evart	2W	Slight	Severe	Severe	Severe	Quaking aspen-----	45	32	
						Red maple-----	40	22	
						Northern whitecedar-	15	26	
						Black spruce-----	15	23	
						Balsam fir-----	40	71	
						Tamarack-----	35	23	
						Swamp white oak----	---	---	
64B, 64C----- Melita	3S	Slight	Moderate	Moderate	Slight	Sugar maple-----	61	38	Red pine, eastern white pine.
						Quaking aspen-----	---	---	
						Red pine-----	---	---	
						Red maple-----	---	---	
						Eastern white pine--	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Black cherry-----	---	---	
						American beech-----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
65----- Arnheim	5W	Slight	Severe	Moderate	Severe	White spruce----- Northern whitecedar- Red maple----- Balsam fir----- Black spruce----- Paper birch----- American elm----- Quaking aspen----- Tamarack-----	38 --- --- --- --- --- --- ---	68 --- --- --- --- --- --- ---	
70----- Loxley	2W	Slight	Severe	Severe	Severe	Black spruce----- Tamarack----- Balsam fir-----	15 --- ---	23 --- ---	
71----- Dawson	2W	Slight	Severe	Severe	Severe	Black spruce----- Tamarack-----	15 ---	23 ---	
74----- Cathro	5W	Slight	Severe	Severe	Severe	Balsam fir----- Northern whitecedar- Tamarack----- Paper birch----- Red maple----- Black spruce----- White spruce-----	40 15 35 --- 40 15 ---	71 26 23 --- 22 23 ---	
76----- Lupton	2W	Slight	Severe	Severe	Severe	Black spruce----- Balsam fir----- Black ash----- Northern whitecedar- Paper birch----- Tamarack----- Red maple----- Quaking aspen----- White spruce-----	20 46 --- --- --- --- --- --- ---	29 86 --- --- --- --- --- --- ---	
77----- Tawas	5W	Slight	Severe	Severe	Severe	Balsam fir----- Northern whitecedar- Quaking aspen----- Black ash----- Red maple-----	40 --- --- --- ---	71 --- --- --- ---	
82B**, 82C**: Nester-----	3L	Slight	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak--- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
Manistee-----	3A	Slight	Slight	Slight	Slight	Sugar maple----- Eastern white pine-- Red maple----- Red pine----- American basswood--- Eastern hemlock----- Northern red oak--- White ash-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	Red pine, eastern white pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
82D**: Nester-----	3L	Slight	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood----- Northern red oak----- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
Manistee-----	3A	Moderate	Moderate	Slight	Slight	Sugar maple----- Eastern white pine----- Red maple----- Red pine----- American basswood----- Eastern hemlock----- Northern red oak----- White ash-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	Red pine, eastern white pine.
82E**: Nester-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood----- Northern red oak----- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
Manistee-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple----- Eastern white pine----- Red maple----- Red pine----- American basswood----- Eastern hemlock----- Northern red oak----- White ash-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	Red pine, eastern white pine.
83B**, 83C**: Rubicon-----	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen----- Red pine----- Northern red oak----- White oak-----	75 --- 80 70	87 --- 80 66	Red pine, jack pine.
Menominee-----	6S	Slight	Moderate	Moderate	Slight	Quaking aspen----- Red pine----- Black cherry----- Paper birch----- Yellow birch----- American basswood-----	74 --- --- --- --- ---	86 --- --- --- --- ---	Red pine, white spruce, eastern white pine.
83E**: Rubicon-----	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen----- Red pine----- Northern red oak----- White oak-----	75 --- 80 70	87 --- 80 66	Red pine, jack pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
83E**: Menominee-----	6R	Moderate	Moderate	Moderate	Slight	Quaking aspen----- Red pine----- Black cherry----- Paper birch----- Yellow birch----- American basswood---	74 --- --- --- --- ---	86 --- --- --- --- ---	Red pine, white spruce, eastern white pine.
85B**: Kent-----	8C	Slight	Severe	Slight	Slight	White spruce----- Balsam fir----- American basswood--- Eastern hemlock----- Quaking aspen----- Eastern white pine-- American beech----- American elm-----	54 54 55 --- --- --- --- ---	105 105 42 --- --- --- --- ---	White spruce, eastern white pine.
Selkirk-----	2C	Slight	Severe	Moderate	Severe	Red maple----- White spruce----- Red maple----- Eastern hemlock----- Balsam fir----- Quaking aspen-----	45 45 --- --- 45 ---	27 84 --- --- 83 ---	White spruce, eastern white pine, northern whitecedar.
86C**: Nester-----	3L	Slight	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak---- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
Graycalm-----	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen----- Northern red oak---- Jack pine----- Red pine----- Paper birch----- Eastern white pine-- American beech-----	70 --- 56 64 --- --- ---	81 --- 78 112 --- --- ---	Red pine, eastern white pine.
86D**: Nester-----	3L	Slight	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak---- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
Graycalm-----	6S	Moderate	Moderate	Moderate	Slight	Bigtooth aspen----- Northern red oak---- Jack pine----- Red pine----- Paper birch----- Eastern white pine-- American beech-----	70 --- 56 64 --- --- ---	81 --- 78 112 --- --- ---	Red pine, eastern white pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
86E**: Nester-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple----- Quaking aspen----- White ash----- American basswood--- Northern red oak---- White oak----- Black cherry----- American beech-----	61 --- --- --- --- --- --- ---	38 --- --- --- --- --- --- ---	White spruce, red pine, Norway spruce, eastern white pine.
Graycalm-----	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen----- Northern red oak---- Jack pine----- Red pine----- Paper birch----- Eastern white pine-- American beech-----	70 --- 56 64 --- --- ---	81 --- 78 112 --- --- ---	Red pine, eastern white pine.
87C**: Isabella-----	6L	Slight	Moderate	Slight	Slight	Northern red oak---- White oak----- Red maple-----	80 70 ---	80 66 ---	Red pine, Norway spruce, white spruce.
Melita-----	6S	Slight	Moderate	Moderate	Slight	Northern red oak---- White oak----- Red maple-----	80 70 ---	80 66 ---	Red pine, eastern white pine.
87E**: Isabella-----	6R	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak----- Red maple-----	80 70 ---	80 66 ---	Red pine, Norway spruce, white spruce.
Melita-----	6R	Moderate	Moderate	Moderate	Slight	Northern red oak---- White oak----- Red maple-----	80 70 ---	80 66 ---	Red pine, eastern white pine.
90C**: Rubicon-----	4S	Slight	Moderate	Moderate	Slight	Quaking aspen----- Jack pine----- Red pine----- Bigtooth aspen----- Northern red oak---- Red maple----- Paper birch----- Eastern white pine--	60 53 50 --- --- --- --- 45	64 73 75 --- --- --- --- 75	Red pine, jack pine.
Montcalm-----	3A	Slight	Slight	Slight	Slight	Sugar maple----- Yellow birch----- Northern red oak---- Eastern white pine-- Red pine----- White oak-----	61 --- 66 --- --- 65	38 --- 60 --- --- 59	Red pine, eastern white pine, white spruce.
93C**, 93D**: Klackings-----	6S	Slight	Moderate	Moderate	Slight	Bigtooth aspen----- White oak----- Northern red oak---- Red maple----- Black cherry-----	70 57 60 --- ---	81 46 51 --- ---	Eastern white pine, red pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
93C**, 93D**: Isabella-----	3L	Slight	Moderate	Slight	Slight	Sugar maple-----	70	43	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine--	---	---	
						American beech-----	---	---	
						White oak-----	65	59	
						Northern red oak----	80	80	
						White ash-----	80	80	
93E**: Klackings-----	6R	Moderate	Moderate	Moderate	Slight	Bigtooth aspen-----	70	81	Eastern white pine, red pine.
						White oak-----	57	46	
						Northern red oak----	60	51	
						Red maple-----	---	---	
						Black cherry-----	---	---	
Isabella-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple-----	70	43	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine--	---	---	
						American beech-----	---	---	
						White oak-----	70	66	
						Northern red oak----	80	80	
						White ash-----	80	80	
94B**, 94C**: Isabella-----	3L	Slight	Moderate	Slight	Slight	Sugar maple-----	61	38	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine--	---	---	
						American beech-----	---	---	
						White oak-----	---	---	
Montcalm-----	3A	Slight	Slight	Slight	Slight	Sugar maple-----	61	38	Red pine, eastern white pine, white spruce.
						Yellow birch-----	---	---	
						Northern red oak----	66	60	
						Eastern white pine--	---	---	
						Red pine-----	---	---	
94E**: Isabella-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple-----	61	38	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine--	---	---	
						American beech-----	---	---	
						White oak-----	---	---	
Montcalm-----	3R	Moderate	Moderate	Slight	Slight	Sugar maple-----	61	38	Red pine, eastern white pine, white spruce.
						Yellow birch-----	---	---	
						Northern red oak----	66	60	
						Eastern white pine--	---	---	
						Red pine-----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Volume*	
97B**, 97C**: Isabella-----	3L	Slight	Moderate	Slight	Slight	Sugar maple-----	72	44	Red pine, Norway spruce, white spruce.
						Red maple-----	---	---	
						Paper birch-----	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Eastern white pine--	---	---	
						American beech-----	---	---	
						White oak-----	70	66	
						Northern red oak----	80	80	
Melita-----	3S	Slight	Moderate	Moderate	Slight	Sugar maple-----	61	38	Red pine, eastern white pine.
						Quaking aspen-----	---	---	
						Red pine-----	---	---	
						Red maple-----	---	---	
						Eastern white pine--	---	---	
						Yellow birch-----	---	---	
						American basswood---	---	---	
						Black cherry-----	---	---	
						American beech-----	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND

(Only the soils suitable for production of commercial trees are listed. Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
10B----- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
10C----- Grayling	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
10E----- Grayling	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
11B----- Rubicon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
11C----- Rubicon	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
11E----- Rubicon	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
11F----- Rubicon	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
12B----- Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
13A----- Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
14----- Roscommon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.
17B----- Graycalm	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
17C----- Graycalm	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
17E----- Graycalm	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
18B----- Klacking	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
18C----- Klacking	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
18E----- Klacking	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
20B----- Montcalm	Slight-----	Slight-----	Slight-----	Year round---	Slight-----	Slight-----	Slight.
20C----- Montcalm	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.
20E----- Montcalm	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round---	Moderate: slope.	Severe: slope.	Moderate: slope.
22B, 22B2----- Nester	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
22C, 22C2----- Nester	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
22D, 22D2----- Nester	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
22D3----- Nester	Moderate: low strength.	Moderate: slope, too clayey, low strength.	Moderate: low strength, too clayey.	Summer, fall, winter.	Slight-----	Moderate: slope, too clayey.	Moderate: too clayey.
22E----- Nester	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
22F----- Nester	Severe: slope.	Severe: slope.	Severe: slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
23B----- Kawkawlin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
24----- Sims	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
25B, 25B2----- Kent	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
25C, 25C2----- Kent	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
25D----- Kent	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
26B----- Selkirk	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
27----- Pickford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.
30B----- Isabella	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
30C----- Isabella	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
30D----- Isabella	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
30E----- Isabella	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
32----- Angelica	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.
36B----- Alcona	Slight-----	Slight-----	Slight-----	Year round--	Slight-----	Slight-----	Slight.
37A----- Ingalls	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
38----- Tonkey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
42C*: Nester-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Mancelona-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
43B----- East Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
44B----- Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
45----- Wheatley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.
46B----- Mancelona	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
46C----- Mancelona	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
46E----- Mancelona	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
46F----- Mancelona	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
47A----- Gladwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
48----- Epoufette	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.
49A----- Colonville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer-----	Slight-----	Slight-----	Slight.
50B----- Menominee	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
50C----- Menominee	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
50D----- Menominee	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
50E----- Menominee	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
51B----- Iosco	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
52----- Brevort	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight-----	Slight-----	Slight.
53B----- Manistee	Slight-----	Slight-----	Slight-----	Year round---	Slight-----	Slight-----	Slight.
53C----- Manistee	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.
53D----- Manistee	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.
54B----- Allendale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
57A----- Belding	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
63----- Ewart	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter-----	Slight-----	Slight-----	Slight.
64B----- Melita	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
64C----- Melita	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
65----- Arnheim	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter-----	Slight-----	Slight-----	Slight.
70----- Loxley	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
71----- Dawson	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
74----- Cathro	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
76----- Lupton	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
77----- Tawas	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
78----- Rondeau	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
79----- Grousehaven	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter-----	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
82B*: Nester-----	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
Manistee-----	Slight-----	Slight-----	Slight-----	Year round---	Slight-----	Slight-----	Slight.
82C*: Nester-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Manistee-----	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.
82D*: Nester-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Manistee-----	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
82E*: Nester-----	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Manistee-----	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round---	Moderate: slope.	Severe: slope.	Moderate: slope.
83B*: Rubicon-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
Menominee-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
83C*: Rubicon-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
Menominee-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
83E*: Rubicon-----	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Menominee-----	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
85B*: Kent-----	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
Selkirk-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
86C*: Nester-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
86C*: Graycalm-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
86D*: Nester-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Graycalm-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
86E*: Nester-----	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Graycalm-----	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
87C*: Isabella-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Melita-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
87E*: Isabella-----	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Melita-----	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
90C*: Rubicon-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
90C*: Montcalm-----	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.
93C*: Klackings-----	Moderate: too sandy.	Moderate: slope.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
Isabella-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
93D*: Klackings-----	Moderate: too sandy.	Moderate: slope.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
Isabella-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.
93E*: Klackings-----	Moderate: slope, too sandy.	Severe: slope.	Moderate: slope, too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Isabella-----	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
94B*: Isabella-----	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
Montcalm-----	Slight-----	Slight-----	Slight-----	Year round---	Slight-----	Slight-----	Slight.
94C*: Isabella-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Montcalm-----	Slight-----	Moderate: slope.	Slight-----	Year round---	Slight-----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
94E*:							
Isabella-----	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
Montcalm-----	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round---	Moderate: slope.	Severe: slope.	Moderate: slope.
97B*:							
Isabella-----	Moderate: low strength.	Slight-----	Moderate: low strength.	Summer, fall, winter.	Slight-----	Slight-----	Slight.
Melita-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Slight-----	Slight.
97C*:							
Isabella-----	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Summer, fall, winter.	Slight-----	Moderate: slope.	Slight.
Melita-----	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight-----	Moderate: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10B, 10C, 10E----- Grayling	Vanhoutte spirea, manyflower cotoneaster.	Lilac, Siberian peashrub, Amur privet, eastern redcedar, Amur maple.	Jack pine-----	Eastern white pine, red pine.	---
11B, 11C, 11E, 11F----- Rubicon	Manyflower cotoneaster.	Eastern redcedar, Siberian crabapple, Amur privet, lilac, Amur maple, Siberian peashrub.	---	Red pine, eastern white pine, jack pine.	---
12B----- Croswell	Manyflower cotoneaster.	Lilac, silky dogwood, Amur maple, Amur privet.	Eastern redcedar, Siberian crabapple.	Red pine, Norway spruce, eastern white pine, white spruce.	Imperial Carolina poplar.
13A----- Au Gres	---	Silky dogwood, American cranberrybush, Amur maple, common ninebark, nannyberry viburnum.	White spruce, Manchurian crabapple.	Norway spruce, jack pine, green ash, eastern white pine.	Imperial Carolina poplar.
14. Roscommon					
17B, 17C, 17E----- Graycalm	Vanhoutte spirea, manyflower cotoneaster.	Siberian peashrub, lilac, Amur privet, Amur maple.	Eastern redcedar, Siberian crabapple.	Red pine, jack pine, eastern white pine.	Imperial Carolina poplar.
18B, 18C, 18E----- Klackung	---	Lilac, common ninebark, Roselow sargent crabapple, nannyberry viburnum, Amur maple.	White spruce, Siberian crabapple, eastern redcedar.	Norway spruce, eastern white pine, red pine.	Imperial Carolina poplar.
20B, 20C, 20E----- Montcalm	---	Amur maple, Siberian peashrub, lilac, Roselow sargent crabapple, Amur privet.	Siberian crabapple	Red pine, white spruce, Norway spruce, eastern white pine, jack pine.	Imperial Carolina poplar.
21*: Histosols. Aquents.					

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
22B, 22B2, 22C, 22C2, 22D, 22D2-- Nester	---	Arrowwood, lilac, nannyberry viburnum, common ninebark, white spruce, Amur privet, silky dogwood.	Blue spruce, Siberian crabapple.	Red pine, green ash, eastern white pine.	---
22D3----- Nester	---	Common ninebark, silky dogwood, lilac, Amur privet, arrowwood, nannyberry viburnum.	White spruce, blue spruce, Siberian crabapple.	Red pine, eastern white pine, green ash.	---
22E, 22F----- Nester	---	Arrowwood, lilac, nannyberry viburnum, common ninebark, white spruce, Amur privet, silky dogwood.	Blue spruce, Siberian crabapple.	Red pine, green ash, eastern white pine.	---
23B----- Kawkawlin	Vanhoutte spirea	Roselow sargent crabapple, silky dogwood, Amur maple, lilac, American cranberrybush, nannyberry viburnum, northern whitecedar.	White spruce-----	Red pine, Norway spruce, eastern white pine.	---
24----- Sims	American cranberrybush.	Nannyberry viburnum, silky dogwood, Amur privet, common ninebark.	Northern whitecedar, Manchurian crabapple, eastern white pine, green ash, white spruce.	Norway spruce-----	Imperial Carolina poplar.
25B, 25B2----- Kent	---	Northern whitecedar, nannyberry viburnum, silky dogwood, American cranberrybush, Amur maple, lilac, common ninebark.	Norway spruce, white spruce.	Eastern white pine, green ash, red maple.	---
25C, 25C2, 25D---- Kent	---	Nannyberry viburnum, silky dogwood, American cranberrybush, Amur maple, lilac, common ninebark.	Norway spruce, white spruce, northern whitecedar.	Eastern white pine, green ash, red maple.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
26B----- Selkirk	American cranberrybush.	Northern whitecedar, silky dogwood, redosier dogwood, common ninebark, lilac, nannyberry viburnum.	White spruce, eastern redcedar.	Red maple, eastern white pine, white ash.	---
27----- Pickford	---	Silky dogwood, American cranberrybush, silky dogwood, common ninebark, nannyberry viburnum.	White spruce, Manchurian crabapple, red maple, northern whitecedar, Norway spruce.	Eastern white pine, green ash.	---
28. Udorthents					
29. Udipsamments					
30B, 30C, 30D, 30E----- Isabella	---	Nannyberry viburnum, lilac, common ninebark, silky dogwood, American cranberrybush, Amur privet.	White spruce, Siberian crabapple.	Red pine, Norway spruce, eastern white pine, green ash.	---
32----- Angelica	---	Silky dogwood, American cranberrybush, nannyberry viburnum, lilac, Siberian peashrub, redosier dogwood.	White spruce, northern whitecedar, eastern redcedar.	Red maple, eastern white pine, green ash.	---
36B----- Alcona	---	Arrowwood, nannyberry viburnum, Siberian crabapple, Amur privet, American cranberrybush, lilac, silky dogwood.	White spruce-----	Norway spruce, eastern white pine, red pine.	Imperial Carolina poplar.
37A----- Ingalls	---	American cranberrybush, lilac, silky dogwood, Amur privet, common ninebark, Roselow sargent crabapple.	White spruce, northern whitecedar, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
38----- Tonkey	---	Northern whitecedar, silky dogwood, arrowwood, common ninebark, American cranberrybush, redosier dogwood.	Norway spruce, green ash, white spruce, Manchurian crabapple.	Eastern white pine, red maple.	---
39*. Pits					
42C*: Nester-----	---	Arrowwood, lilac, nannyberry viburnum, common ninebark, white spruce, Amur privet, silky dogwood.	Blue spruce, Siberian crabapple.	Red pine, green ash, eastern white pine.	---
Mancelona-----	---	Amur maple, lilac, eastern redcedar, Siberian peashrub.	White spruce, Siberian crabapple, northern whitecedar.	Red pine, jack pine, eastern white pine, Norway spruce.	Imperial Carolina poplar.
43B----- East Lake	Manyflower cotoneaster.	Siberian peashrub, Amur maple, lilac, Amur privet, eastern redcedar.	Siberian crabapple	Red pine, eastern white pine, jack pine.	---
44B----- Croswell	---	Nannyberry viburnum, lilac, Siberian peashrub, eastern redcedar.	Manchurian crabapple, white spruce.	Eastern white pine, red pine, jack pine, Norway spruce, green ash.	Imperial Carolina poplar.
45. Wheatley					
46B, 46C, 46E, 46F----- Mancelona	---	Amur maple, lilac, eastern redcedar, Siberian peashrub.	White spruce, Siberian crabapple, northern whitecedar.	Red pine, jack pine, eastern white pine, Norway spruce.	Imperial Carolina poplar.
47A----- Gladwin	---	Lilac, American cranberrybush, nannyberry viburnum, Roselow sargent crabapple, Amur maple, silky dogwood.	White spruce, northern whitecedar, Manchurian crabapple.	Eastern white pine, green ash.	Imperial Carolina poplar.
48. Epoufette					

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
49A----- Colonville	---	Silky dogwood, nannyberry viburnum, American cranberrybush, Amur privet, lilac.	White spruce, northern whitecedar, Siberian crabapple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
50B, 50C, 50D, 50E----- Menominee	---	Lilac, arrowwood, nannyberry viburnum, Amur maple, Amur privet.	Eastern redcedar, Siberian crabapple.	Red pine, eastern white pine, Norway spruce, white spruce.	Imperial Carolina poplar.
51B----- Iosco	---	Common ninebark, American cranberrybush, Amur privet, nannyberry viburnum, silky dogwood.	White spruce, northern whitecedar, Manchurian crabapple.	Green ash, eastern white pine, Norway spruce.	---
52----- Brevort	---	---	---	---	---
53B, 53C, 53D----- Manistee	---	Silky dogwood, Amur maple, nannyberry viburnum, lilac, Amur privet, American cranberrybush.	White spruce, Siberian crabapple, eastern redcedar.	Red pine, Norway spruce, eastern white pine.	---
54B----- Allendale	---	American cranberrybush, silky dogwood, Amur privet, lilac, nannyberry viburnum, Roselow sargent crabapple.	White spruce, northern whitecedar, Manchurian crabapple.	Eastern white pine, red maple, Norway spruce.	---
57A----- Belding	---	Common ninebark, American cranberrybush, nannyberry viburnum, silky dogwood, lilac.	White spruce, Siberian crabapple, northern whitecedar.	Eastern white pine, red maple, Norway spruce, green ash.	---
63. Evart					
64B, 64C----- Melita	---	Siberian peashrub, Siberian crabapple, common ninebark, Amur privet, lilac, Roselow sargent crabapple.	Eastern redcedar	Red pine, jack pine, Norway spruce, eastern white pine.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
65. Arnheim					
70----- Loxley	---	Common ninebark, nannyberry viburnum, silky dogwood.	Northern whitecedar.	Siberian crabapple, eastern white pine, green ash.	---
71. Dawson					
74. Cathro					
76. Lupton					
77----- Tawas	American cranberrybush.	Silky dogwood, Amur privet, lilac, Roselow sargent crabapple.	Northern whitecedar, eastern white pine, Manchurian crabapple, white spruce.	Green ash, Norway spruce.	---
78. Rondeau					
79. Grousehaven					
82B*, 82C*, 82D*, 82E*: Nester-----	---	Arrowwood, lilac, nannyberry viburnum, common ninebark, white spruce, Amur privet, silky dogwood.	Blue spruce, Siberian crabapple.	Red pine, green ash, eastern white pine.	---
Manistee-----	---	Silky dogwood, Amur maple, nannyberry viburnum, lilac, Amur privet, American cranberrybush.	White spruce, Siberian crabapple, eastern redcedar.	Red pine, Norway spruce, eastern white pine.	---
83B*, 83C*, 83E*: Rubicon-----	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, Manchurian crabapple.	Jack pine-----	Red pine, eastern white pine.	---
Menominee-----	---	Lilac, arrowwood, nannyberry viburnum, Amur maple, Amur privet.	Eastern redcedar, Siberian crabapple.	Red pine, eastern white pine, Norway spruce, white spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
85B*: Kent-----	---	Northern whitecedar, nannyberry viburnum, silky dogwood, American cranberrybush, Amur maple, lilac, common ninebark.	Norway spruce, white spruce.	Eastern white pine, green ash, red maple.	---
Selkirk-----	American cranberrybush.	Northern whitecedar, silky dogwood, redosier dogwood, common ninebark, lilac, nannyberry viburnum.	White spruce, eastern redcedar.	Red maple, eastern white pine, white ash.	---
86C*, 86D*, 86E*: Nester-----	---	Arrowwood, lilac, nannyberry viburnum, common ninebark, white spruce, Amur privet, silky dogwood.	Blue spruce, Siberian crabapple.	Red pine, green ash, eastern white pine.	---
Graycalm-----	Vanhoutte spirea, manyflower cotoneaster.	Siberian peashrub, lilac, Amur privet, Amur maple.	Eastern redcedar, Siberian crabapple.	Red pine, jack pine, eastern white pine.	Imperial Carolina poplar.
87C*, 87E*: Isabella-----	---	Common ninebark, Amur privet, lilac, American cranberrybush, silky dogwood, nannyberry viburnum.	Siberian crabapple, white spruce.	Norway spruce, red pine, eastern white pine, green ash.	---
Melita.					
90C*: Rubicon-----	Manyflower cotoneaster.	Eastern redcedar, Siberian crabapple, Amur privet, lilac, Amur maple, Siberian peashrub.	---	Red pine, eastern white pine, jack pine.	---
Montcalm-----	---	Amur maple, Siberian peashrub, lilac, Roselow sargent crabapple, Amur privet.	Siberian crabapple	Red pine, white spruce, Norway spruce, eastern white pine, jack pine.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
93C*, 93D*, 93E*: Klacking-----	---	Lilac, common ninebark, Roselow sargent crabapple, nannyberry viburnum, Amur maple.	White spruce, Siberian crabapple, eastern redcedar.	Norway spruce, eastern white pine, red pine.	Imperial Carolina poplar.
Isabella-----	---	Nannyberry viburnum, lilac, common ninebark, silky dogwood, American cranberrybush, Amur privet.	White spruce, Siberian crabapple.	Red pine, Norway spruce, eastern white pine, green ash.	---
94B*, 94C*, 94E*: Isabella-----	---	Nannyberry viburnum, lilac, common ninebark, silky dogwood, American cranberrybush, Amur privet.	White spruce, Siberian crabapple.	Red pine, Norway spruce, eastern white pine, green ash.	---
Montcalm-----	---	Amur maple, Siberian peashrub, lilac, Roselow sargent crabapple, Amur privet.	Siberian crabapple	Red pine, white spruce, Norway spruce, eastern white pine, jack pine.	Imperial Carolina poplar.
97B*, 97C*: Isabella-----	---	Nannyberry viburnum, lilac, common ninebark, silky dogwood, American cranberrybush, Amur privet.	White spruce, Siberian crabapple.	Red pine, Norway spruce, eastern white pine, green ash.	---
Melita-----	---	Siberian peashrub, Siberian crabapple, common ninebark, Amur privet, lilac, Roselow sargent crabapple.	Eastern redcedar	Red pine, jack pine, Norway spruce, eastern white pine.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
10B----- Grayling	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
10C----- Grayling	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
10E----- Grayling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
11B----- Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
11C----- Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
11E, 11F----- Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
12B----- Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
13A----- Au Gres	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
14----- Roscommon	Severe: ponding.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
17B----- Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
17C----- Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
17E----- Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
18B----- Klackling	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
18C----- Klackling	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
18E----- Klackling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
20B----- Montcalm	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
20C----- Montcalm	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
20E----- Montcalm	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21*: Histosols. Aquents.				
22B, 22B2----- Nester	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
22C, 22C2----- Nester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
22D, 22D2, 22D3----- Nester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
22E, 22F----- Nester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
23B----- Kawkawlin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
24----- Sims	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
25B, 25B2----- Kent	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
25C----- Kent	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
25C2----- Kent	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
25D----- Kent	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
26B----- Selkirk	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
27----- Pickford	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
28. Udorthents				
29. Udipsamments				
30B----- Isabella	Slight-----	Slight-----	Moderate: slope.	Slight.
30C----- Isabella	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
30D----- Isabella	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
30E----- Isabella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
32----- Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
36B----- Alcona	Slight-----	Slight-----	Moderate: slope.	Slight.
37A----- Ingalls	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
38----- Tonkey	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
39*. Pits				
42C*: Nester-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Mancelona-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
43B----- East Lake	Severe: too sandy.	Severe: too sandy.	Moderate: slope, small stones.	Severe: too sandy.
44B----- Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
45----- Wheatley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
46B----- Mancelona	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
46C----- Mancelona	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
46E, 46F----- Mancelona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.
47A----- Gladwin	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
48----- Epoufette	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
49A----- Colonville	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.
50B----- Menominee	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
50C----- Menominee	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
50D----- Menominee	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
50E----- Menominee	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
51B----- Iosco	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
52----- Brevort	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
53B----- Manistee	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
53C----- Manistee	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight.
53D----- Manistee	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.
54B----- Allendale	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
57A----- Belding	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
63----- Evart	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness, flooding.	Severe: wetness, too sandy.
64B----- Melita	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
64C----- Melita	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
65----- Arnheim	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
70----- Loxley	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.
71----- Dawson	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
74----- Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
76----- Lupton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
77----- Tawas	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
78----- Rondeau	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
79----- Grousehaven	Severe: ponding, percs slowly, excess humus.	Severe: ponding, excess humus, percs slowly.	Severe: excess humus, ponding, percs slowly.	Severe: ponding, excess humus.
82B*: Nester-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
Manistee-----	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
82C*: Nester-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Manistee-----	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight.
82D*: Nester-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Manistee-----	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.
82E*: Nester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Manistee-----	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
83B*: Rubicon-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Menominee-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
83C*: Rubicon-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Menominee-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
83E*: Rubicon-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Menominee-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
85B*: Kent-----	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
Selkirk-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
86C*: Nester-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Graycalm-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
86D*: Nester-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Graycalm-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
86E*: Nester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Graycalm-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
87C*: Isabella-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
87C*: Melita-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
87E*: Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Melita-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
90C*: Rubicon-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Montcalm-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
93C*: Klacking-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Isabella-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
93D*, 93E*: Klacking-----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
94B*: Isabella-----	Slight-----	Slight-----	Moderate: slope.	Slight.
Montcalm-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
94C*: Isabella-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Montcalm-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
94E*: Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Montcalm-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
97B*: Isabella-----	Slight-----	Slight-----	Moderate: slope.	Slight.
Melita-----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
97C*: Isabella-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Melita-----	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10B----- Grayling	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
10C----- Grayling	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
10E----- Grayling	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
11B----- Rubicon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
11C----- Rubicon	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
11E, 11F----- Rubicon	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
12B----- Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
13A----- Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
14----- Roscommon	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
17B, 17C----- Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
17E----- Graycalm	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
18B----- Klackling	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
18C----- Klackling	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
18E----- Klackling	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
20B, 20C----- Montcalm	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
20E----- Montcalm	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
21*: Histosols. Aquents.										
22B, 22B2----- Nester	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
22C, 22C2----- Nester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22D, 22D2----- Nester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
22D3----- Nester	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
22E, 22F----- Nester	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
23B----- Kawkawlin	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
24----- Sims	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
25B, 25B2----- Kent	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
25C, 25C2----- Kent	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
25D----- Kent	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
26B----- Selkirk	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
27----- Pickford	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
28. Udorthents										
29. Udipsamments										
30B----- Isabella	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
30C----- Isabella	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
30D, 30E----- Isabella	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
32----- Angelica	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
36B----- Alcona	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
37A----- Ingalls	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
38----- Tonkey	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
39*. Pits										
42C*: Nester-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Mancelona-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
43B----- East Lake	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
44B----- Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
45----- Wheatley	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
46B, 46C----- Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
46E, 46F----- Mancelona	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47A----- Gladwin	Fair	Poor	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
48----- Epoufette	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
49A----- Colonville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
50B, 50C, 50D----- Menominee	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
50E----- Menominee	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
51B----- Iosco	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
52----- Brevort	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
53B, 53C----- Manistee	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
53D----- Manistee	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
54B----- Allendale	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
57A----- Belding	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
63----- Evart	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
64B----- Melita	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
64C----- Melita	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
65----- Arnheim	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
70----- Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
71----- Dawson	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
74----- Cathro	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
76----- Lupton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
77----- Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
78----- Rondeau	Poor	Poor	Poor	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good.
79----- Grousehaven	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Very poor.	Fair.
82B*: Nester-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Manistee-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
82C*: Nester-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Manistee-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
82D*: Nester-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Manistee-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
82E*: Nester-----	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Manistee-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
83B*: Rubicon-----	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Menominee-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83C*: Rubicon-----	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Menominee-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83E*: Rubicon-----	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Menominee-----	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
85B*: Kent-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Selkirk-----	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
86C*: Nester-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Graycalm-----	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
86D*: Nester-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Graycalm-----	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
86E*: Nester-----	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Graycalm-----	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
87C*: Isabella-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Melita-----	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
87E*: Isabella-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
87E*: Melita-----	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
90C*: Rubicon-----	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Montcalm-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
93C*: Klacking-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Isabella-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
93D*, 93E*: Klacking-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Isabella-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
94B*: Isabella-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Montcalm-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
94C*: Isabella-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Montcalm-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
94E*: Isabella-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Montcalm-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
97B*: Isabella-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Melita-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
97C*: Isabella-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Melita-----	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10B----- Grayling	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: droughty.
10C----- Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
10E----- Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
11B----- Rubicon	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: droughty.
11C----- Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
11E, 11F----- Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
12B----- Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
13A----- Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
14----- Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
17B----- Graycalm	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: droughty.
17C----- Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
17E----- Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
18B----- Klackung	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty, too sandy.
18C----- Klackung	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
18E----- Klackung	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
20B----- Montcalm	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
20C----- Montcalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
20E----- Montcalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21*: Histosols. Aquents.						
22B, 22B2----- Nester	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
22C, 22C2----- Nester	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
22D, 22D2, 22D3, 22E, 22F----- Nester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
23B----- Kawkawlin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
24----- Sims	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
25B----- Kent	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: droughty.
25B2----- Kent	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
25C----- Kent	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: droughty, slope.
25C2----- Kent	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
25D----- Kent	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
26B----- Selkirk	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27----- Pickford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
28. Udorthents						
29. Udipsamments						
30B----- Isabella	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: large stones.
30C----- Isabella	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: large stones, slope.
30D, 30E----- Isabella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
32----- Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
36B----- Alcona	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
37A----- Ingalls	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
38----- Tonkey	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
39*. Pits						
42C*: Nester-----	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Mancelona-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, droughty, slope.
43B----- East Lake	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
44B----- Croswell	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Slight-----	Moderate: droughty, too sandy.
45----- Wheatley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
46B----- Mancelona	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: small stones, droughty.
46C----- Mancelona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, droughty, slope.
46E, 46F----- Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47A----- Gladwin	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
48----- Epoufette	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, droughty.
49A----- Colonville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
50B----- Menominee	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: large stones.
50C----- Menominee	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, slope.
50D, 50E----- Menominee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
51B----- Iosco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
52----- Brevort	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
53B----- Manistee	Severe: cutbanks cave.	Slight-----	Severe: shrink-swell.	Slight-----	Slight-----	Moderate: droughty.
53C----- Manistee	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
53D----- Manistee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.	Severe: slope.
54B----- Allendale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
57A----- Belding	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
63----- Evart	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
64B----- Melita	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: droughty.
64C----- Melita	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
65----- Arnheim	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
70----- Loxley	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: too acid, ponding, excess humus.
71----- Dawson	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
74----- Cathro	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
76----- Lupton	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
77----- Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
78----- Rondeau	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, excess humus.
79----- Grousehaven	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding, excess humus.
82B*: Nester-----	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Manistee-----	Severe: cutbanks cave.	Slight-----	Severe: shrink-swell.	Moderate: slope.	Slight-----	Moderate: droughty.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
82C*: Nester-----	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Manistee-----	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
82D*, 82E*: Nester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Manistee-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.	Severe: slope.
83B*: Rubicon-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: droughty.
Menominee-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: large stones.
83C*: Rubicon-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Menominee-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, slope.
83E*: Rubicon-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Menominee-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
85B*: Kent-----	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: droughty.
Selkirk-----	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
86C*: Nester-----	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Graycalm-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
86D*, 86E*: Nester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Graycalm-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
87C*: Isabella-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: large stones, slope.
Melita-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
87E*: Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Melita-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
90C*: Rubicon-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Montcalm-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
93C*: Klackung-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Isabella-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: large stones, slope.
93D*, 93E*: Klackung-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
94B*: Isabella-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: large stones.
Montcalm-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
94C*: Isabella-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: large stones, slope.
Montcalm-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
94E*: Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Montcalm-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
97B*: Isabella-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: large stones.
Melita-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: droughty.
97C*: Isabella-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: large stones, slope.
Melita-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10B----- Grayling	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
10C----- Grayling	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
10E----- Grayling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
11B----- Rubicon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
11C----- Rubicon	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
11E, 11F----- Rubicon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
12B----- Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
13A----- Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
14----- Roscommon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
17B----- Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17C----- Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17E----- Graycalm	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
18B----- Klacking	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
18C----- Klackung	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
18E----- Klackung	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
20B----- Montcalm	Slight-----	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20C----- Montcalm	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20E----- Montcalm	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
21*: Histosols. Aquents.					
22B, 22B2----- Nester	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey, small stones.
22C, 22C2----- Nester	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
22D, 22D2, 22D3, 22E, 22F----- Nester	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
23B----- Kawkawlin	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
24----- Sims	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
25B, 25B2----- Kent	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
25C, 25C2----- Kent	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
25D----- Kent	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
26B----- Selkirk	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
27----- Pickford	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
28. Udorthents					
29. Udipsamments					
30B----- Isabella	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
30C----- Isabella	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
30D, 30E----- Isabella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
32----- Angelica	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
36B----- Alcona	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight-----	Poor: too sandy.
37A----- Ingalls	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
38----- Tonkey	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
39*. Pits					
42C*: Nester-----	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
Mancelona-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
43B----- East Lake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
44B----- Croswell	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
45----- Wheatley	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
46B----- Mancelona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
46C----- Mancelona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
46E, 46F----- Mancelona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
47A----- Gladwin	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
48----- Epoufette	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
49A----- Colonville	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy, wetness.
50B----- Menominee	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
50C----- Menominee	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
50D, 50E----- Menominee	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
51B----- Iosco	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
52----- Brevort	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
53B----- Manistee	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
53C----- Manistee	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
53D----- Manistee	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, slope.
54B----- Allendale	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
57A----- Belding	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
63----- Evart	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
64B----- Melita	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
64C----- Melita	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
65----- Arnheim	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: too sandy, wetness.
70----- Loxley	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
71----- Dawson	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
74----- Cathro	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
76----- Lupton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
77----- Tawas	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
78----- Rondeau	Severe: ponding, subsides.	Severe: seepage, excess humus.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
79----- Grousehaven	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
82B*: Nester-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey, small stones.
Manistee-----	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
82C*: Nester-----	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
Manistee-----	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
82D*, 82E*: Nester-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Manistee-----	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, slope.
83B*: Rubicon-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Menominee-----	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
83C*: Rubicon-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Menominee-----	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
83E*: Rubicon-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Menominee-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
85B*: Kent-----	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Selkirk-----	Severe: wetness, percs slowly.	Slight-----	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
86C*: Nester-----	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
Graycalm-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
86D*, 86E*: Nester-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Graycalm-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
87C*: Isabella-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Melita-----	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
87E*: Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Melita-----	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
90C*: Rubicon-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Montcalm-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
93C*: Klackings-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Isabella-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
93D*, 93E*: Klackings-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
94B*: Isabella-----	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Montcalm-----	Slight-----	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
94C*: Isabella-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Montcalm-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
94E*: Isabella-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
94E*: Montcalm-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
97B*: Isabella-----	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Melita-----	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
97C*: Isabella-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Melita-----	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10B, 10C----- Grayling	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
10E----- Grayling	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
11B, 11C----- Rubicon	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
11E, 11F----- Rubicon	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
12B----- Croswell	Fair: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy.
13A----- Au Gres	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy, wetness.
14----- Roscommon	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy, wetness.
17B, 17C----- Graycalm	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
17E----- Graycalm	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
18B, 18C----- Klacking	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones.
18E----- Klacking	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones, slope.
20B, 20C----- Montcalm	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones.
20E----- Montcalm	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones, slope.
21*: Histosols. Aquents.				

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
22B, 22B2, 22C, 22C2-- Nester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
22D, 22D2----- Nester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
22D3----- Nester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
22E, 22F----- Nester	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
23B----- Kawkawlin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
24----- Sims	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
25B, 25B2, 25C, 25C2-- Kent	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
25D----- Kent	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
26B----- Selkirk	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
27----- Pickford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
28. Udorthents				
29. Udipsamments				
30B----- Isabella	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones.
30C----- Isabella	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones, slope.
30D----- Isabella	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
30E----- Isabella	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
32----- Angelica	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, wetness.
36B----- Alcona	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
37A----- Ingalls	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
38----- Tonkey	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: wetness.
39*. Pits				
42C*: Nester-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Mancelona-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
43B----- East Lake	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
44B----- Croswell	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
45----- Wheatley	Poor: wetness.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
46B, 46C----- Mancelona	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
46E, 46F----- Mancelona	Poor: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
47A----- Gladwin	Poor: wetness.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
48----- Epoufette	Poor: wetness.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
49A----- Colonville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
50B, 50C----- Menominee	Good-----	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones.
50D----- Menominee	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, slope.
50E----- Menominee	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, slope.
51B----- Iosco	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, wetness.
52----- Brevort	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, wetness.
53B, 53C----- Manistee	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
53D----- Manistee	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
54B----- Allendale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
57A----- Belding	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
63----- Evart	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy, wetness.
64B, 64C----- Melita	Good-----	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
65----- Arnheim	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
70----- Loxley	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
71----- Dawson	Poor: wetness.	Probable-----	Probable-----	Poor: excess humus, wetness.
74----- Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
76----- Lupton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
77----- Tawas	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: excess humus, wetness.
78----- Rondeau	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
79----- Grousehaven	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
82B*, 82C*: Nester-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Manistee-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
82D*: Nester-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
Manistee-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
82E*: Nester-----	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
Manistee-----	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
83B*, 83C*: Rubicon-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
Menominee-----	Good-----	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
83E*: Rubicon-----	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
Menominee-----	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, slope.
85B*: Kent-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Selkirk-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
86C*: Nester-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Graycalm-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
86D*: Nester-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
Graycalm-----	Fair: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
86E*: Nester-----	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
Graycalm-----	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
87C*: Isabella-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones, slope.
Melita-----	Good-----	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
87E*: Isabella-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
87E*: Melita-----	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
90C*: Rubicon-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
Montcalm-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones.
93C*: Klackung-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones.
Isabella-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones, slope.
93D*, 93E*: Klackung-----	Fair: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Isabella-----	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
94B*: Isabella-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones.
Montcalm-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones.
94C*: Isabella-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones, slope.
Montcalm-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones.
94E*: Isabella-----	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
94E*: Montcalm-----	Fair: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, small stones, slope.
97B*: Isabella-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones.
Melita-----	Good-----	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
97C*: Isabella-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones, slope.
Melita-----	Good-----	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
10B----- Grayling	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
10C, 10E----- Grayling	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
11B----- Rubicon	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
11C, 11E, 11F----- Rubicon	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
12B----- Croswell	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Droughty.
13A----- Au Gres	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
14----- Roscommon	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
17B----- Graycalm	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
17C, 17E----- Graycalm	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
18B----- Klackung	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
18C, 18E----- Klackung	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
20B----- Montcalm	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
20C, 20E----- Montcalm	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
21*: Histosols. Aquents.						

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
22B----- Nester	Moderate: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Soil blowing, percs slowly.	Rooting depth, percs slowly.
22B2----- Nester	Moderate: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Percs slowly---	Rooting depth, percs slowly.
22C----- Nester	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, soil blowing, percs slowly.	Slope, rooting depth, percs slowly.
22C2----- Nester	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, percs slowly.	Slope, rooting depth, percs slowly.
22D----- Nester	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, soil blowing, percs slowly.	Slope, rooting depth, percs slowly.
22D2----- Nester	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, percs slowly.	Slope, rooting depth, percs slowly.
22D3----- Nester	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, percs slowly.	Slope.
22E, 22F----- Nester	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, soil blowing, percs slowly.	Slope, rooting depth, percs slowly.
23B----- Kawkawlin	Slight-----	Severe: slow refill.	Percs slowly, frost action.	Wetness-----	Wetness, percs slowly.	Wetness, percs slowly.
24----- Sims	Slight-----	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, rooting depth.
25B----- Kent	Moderate: slope.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Wetness, percs slowly.	Percs slowly.
25B2----- Kent	Moderate: slope.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
25C----- Kent	Severe: slope.	Severe: no water.	Deep to water	Slope, droughty, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
25C2----- Kent	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
25D----- Kent	Severe: slope.	Severe: no water.	Deep to water	Slope, droughty, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
26B----- Selkirk	Slight-----	Severe: slow refill.	Percs slowly, frost action.	Wetness-----	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
27----- Pickford	Slight-----	Severe: no water.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
28. Udorthents						
29. Udipsamments						
30B----- Isabella	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing---	Favorable.
30C, 30D, 30E----- Isabella	Severe: slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Slope.
32----- Angelica	Slight-----	Severe: slow refill.	Ponding, frost action.	Ponding, rooting depth.	Ponding-----	Wetness, rooting depth.
36B----- Alcona	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
37A----- Ingalls	Severe: seepage.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
38----- Tonkey	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty, soil blowing.	Ponding, too sandy, soil blowing.	Wetness, droughty, rooting depth.
39*. Pits						
42C*: Nester-----	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, soil blowing, percs slowly.	Slope, rooting depth, percs slowly.
Mancelona-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
43B----- East Lake	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
44B----- Croswell	Severe: seepage.	Severe: no water.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
45----- Wheatley	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
46B----- Mancelona	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
46C, 46E, 46F----- Mancelona	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
47A----- Gladwin	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
48----- Epoufette	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
49A----- Colonville	Severe: seepage.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
50B----- Menominee	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
50C, 50D, 50E----- Menominee	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
51B----- Iosco	Severe: seepage.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
52----- Brevort	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding-----	Ponding, droughty, fast intake.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily, droughty.
53B----- Manistee	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing, percs slowly.	Droughty, rooting depth.
53C, 53D----- Manistee	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing, percs slowly.	Slope, droughty, rooting depth.
54B----- Allendale	Severe: seepage.	Severe: slow refill, cutbanks cave.	Percs slowly---	Wetness, droughty.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
57A----- Belding	Severe: seepage.	Severe: slow refill.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness, rooting depth.
63----- Ewart	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
64B----- Melita	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
64C----- Melita	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
65----- Arnheim	Moderate: seepage.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, droughty.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
70----- Loxley	Severe: seepage.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, too acid.	Ponding-----	Wetness.
71----- Dawson	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, rooting depth.	Ponding-----	Wetness, rooting depth.
74----- Cathro	Severe: seepage.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
76----- Lupton	Severe: seepage.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
77----- Tawas	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding-----	Ponding, too sandy.	Wetness.
78----- Rondeau	Severe: seepage.	Severe: slow refill.	Ponding, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing.	Wetness.
79----- Grousehaven	Severe: seepage.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
82B*: Nester-----	Moderate: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Soil blowing, percs slowly.	Rooting depth, percs slowly.
Manistee-----	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing, percs slowly.	Droughty, rooting depth.
82C*, 82D*, 82E*: Nester-----	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, soil blowing, percs slowly.	Slope, rooting depth, percs slowly.
Manistee-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing, percs slowly.	Slope, droughty, rooting depth.
83B*: Rubicon-----	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Menominee-----	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
83C*, 83E*: Rubicon-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Menominee-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
85B*: Kent-----	Moderate: slope.	Severe: no water.	Percs slowly, slope.	Slope, wetness, droughty.	Wetness, percs slowly.	Percs slowly.
Selkirk-----	Slight-----	Severe: slow refill.	Percs slowly, frost action.	Wetness-----	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
86C*, 86D*, 86E*: Nester-----	Severe: slope.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, soil blowing, percs slowly.	Slope, rooting depth, percs slowly.
Graycalm-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
87C*, 87E*: Isabella-----	Severe: slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
Melita-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
90C*: Rubicon-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Montcalm-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
93C*, 93D*, 93E*: Klackings-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Isabella-----	Severe: slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Slope.
94B*: Isabella-----	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing---	Favorable.
Montcalm-----	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
94C*, 94E*: Isabella-----	Severe: slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Slope.
Montcalm-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
97B*: Isabella-----	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing---	Favorable.
Melita-----	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
97C*: Isabella-----	Severe: slope.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Slope.
Melita-----	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10E, 10C, 10E--- Grayling	0-5	Sand-----	SM, SP-SM, SP	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	5-30	Sand-----	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	45-70	3-15	---	NP
	30-68	Sand-----	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	90-100	40-70	0-15	---	NP
11B, 11C, 11E, 11F----- Rubicon	0-3	Sand-----	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	3-38	Sand-----	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	38-60	Sand-----	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	75-100	30-70	0-15	---	NP
12B----- Croswell	0-11	Sand-----	SP-SM, SM	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	5-15	---	NP
	11-21	Sand-----	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
	21-65	Sand-----	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	90-100	85-100	40-70	3-15	---	NP
13A----- Au Gres	0-8	Sand-----	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	8-31	Sand-----	SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-65	5-15	---	NP
	31-60	Sand-----	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-60	5-15	---	NP
14----- Roscommon	0-5	Mucky sand-----	SM, SP-SM	A-2, A-3, A-1	0	95-100	85-100	40-70	5-15	<20	NP-4
	5-60	Sand-----	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	85-100	40-70	0-15	<20	NP-4
17B, 17C, 17E--- Graycalm	0-2	Sand-----	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	75-100	35-55	0-15	---	NP
	2-44	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	95-100	75-100	30-75	0-30	---	NP
	44-76	Sand, loamy sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	75-100	30-75	0-30	---	NP
18B, 18C, 18E--- Klacking	0-2	Sand-----	SP-SM, SM, SP	A-2, A-1, A-3	0-5	90-100	75-100	35-75	0-15	---	NP
	2-34	Sand, loamy sand	SP-SM, SM, SP	A-2, A-1, A-3	0-5	90-100	75-100	35-75	0-30	---	NP
	34-82	Sand, loamy sand, sandy loam.	SP-SM, SM, SP, SM-SC	A-2, A-4, A-1, A-3	0-5	90-100	75-100	35-70	0-40	<25	NP-7
20B, 20C, 20E--- Montcalm	0-6	Loamy sand-----	SM, SP-SM	A-2, A-1	0-2	90-100	75-100	35-75	10-30	---	NP
	6-30	Loamy sand, sand	SM, SP-SM	A-2, A-1, A-3	0-2	90-100	75-100	35-75	5-30	---	NP
	30-60	Stratified sand to sandy clay loam.	SM, SP-SM, SM-SC, SC	A-2, A-4, A-1, A-3	0-2	90-100	75-100	35-85	5-50	<30	NP-10

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
21*: Histosols. Aquents.											
22B----- Nester	0-8	Fine sandy loam, loam.	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	8-35	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	35-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
22B2----- Nester	0-8	Loam-----	ML, CL, CL-ML, SM	A-4, A-6	0-5	90-100	75-100	65-100	45-90	15-35	2-15
	8-31	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	31-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
22C----- Nester	0-8	Fine sandy loam	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	8-35	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	35-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
22C2----- Nester	0-8	Loam-----	ML, CL, CL-ML, SM	A-4, A-6	0-5	90-100	75-100	65-100	45-90	15-35	2-15
	8-31	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	31-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
22D----- Nester	0-8	Fine sandy loam, loam.	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	8-35	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	35-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
22D2----- Nester	0-8	Loam-----	ML, CL, CL-ML, SM	A-4, A-6	0-5	90-100	75-100	65-100	45-90	15-35	2-15
	8-31	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	31-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
22D3----- Nester	0-8	Clay loam-----	CL	A-6, A-7	0-5	90-100	75-100	70-100	50-80	35-50	15-30
	8-29	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	70-100	55-95	40-55	15-30
	29-60	Clay loam, silty clay loam.	CL, ML	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-20
22E, 22F----- Nester	0-8	Fine sandy loam, loam.	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	8-31	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	31-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
23B----- Kawkawlin	0-9	Loam-----	ML, CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-40	2-15
	9-31	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-5	95-100	85-100	75-100	55-95	40-55	20-30
	31-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-100	75-100	50-95	35-50	15-25
24----- Sims	0-6	Loam-----	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-95	50-75	25-40	5-15
	6-17	Clay loam, silty clay loam.	CL, CH	A-7	0-5	90-100	85-100	75-95	55-90	40-55	20-30
	17-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	85-100	75-95	55-90	40-50	20-25
25B----- Kent	0-9	Sandy loam-----	SM, SM-SC, SC, ML	A-4, A-2	0-4	95-100	90-100	55-85	25-55	<30	NP-10
	9-23	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
	23-60	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
25B2----- Kent	0-8	Loam-----	CL	A-6	0-4	95-100	90-100	75-100	55-90	20-35	10-20
	8-17	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
	17-60	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
25C----- Kent	0-9	Sandy loam-----	SM, SM-SC, SC, ML	A-4, A-2	0-4	95-100	90-100	55-85	25-55	10-30	NP-10
	9-23	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
	23-60	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
25C2----- Kent	0-8	Loam-----	CL	A-6	0-4	95-100	90-100	75-100	50-90	20-35	10-20
	8-17	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
	17-60	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
25D----- Kent	0-9	Sandy loam-----	SM, SM-SC, SC, ML	A-4, A-2	0-4	95-100	90-100	55-85	25-55	10-30	NP-10
	9-23	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
	23-60	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
26B----- Selkirk	0-10	Loam-----	CL-ML, CL	A-4, A-6	0-5	90-100	85-100	70-100	50-90	25-40	5-20
	10-16	Clay, silty clay	CH	A-7	0-5	90-100	85-100	80-100	65-95	50-70	25-40
	16-60	Clay, silty clay	CH	A-7	0-5	90-100	85-100	80-100	65-95	50-70	25-40
27----- Pickford	0-9	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	70-95	30-50	10-25
	9-30	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	75-95	40-70	20-40
	30-60	Clay-----	CH, CL	A-7	0	100	100	90-100	75-95	45-70	25-40
28. Udorthents											
29. Udipsamments											
30B, 30C, 30D, 30E----- Isabella	0-3	Loamy sand-----	SM, SP-SM	A-2, A-1	0-10	95-100	90-100	45-75	10-30	<20	NP-4
	3-12	Sandy loam, fine sandy loam, loam.	CL, SC, ML, SM	A-6, A-2, A-4	0-10	95-100	90-100	55-95	25-75	<30	NP-11
	12-24	Sandy loam, loam, sandy clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-10	95-100	90-100	55-95	25-75	20-40	5-20
	24-33	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-2, A-4, A-7	0-10	95-100	90-100	70-95	30-75	25-45	9-22
	33-60	Fine sandy loam, loam, clay loam.	SC, CL	A-6, A-4, A-7	0-10	95-100	90-100	65-95	35-75	25-45	7-22

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In										
32----- Angelica	0-5	Loam-----	ML	A-4, A-6	0-10	90-100	85-100	80-100	55-90	25-40	2-13
	5-13	Sandy clay loam, loam, clay loam.	SC, CL, CL-ML	A-2-4, A-6, A-4, A-2-6	0-10	90-100	85-100	70-100	55-90	15-40	5-23
	13-60	Loam, silt loam	ML, SM, CL, SC	A-4, A-6	0-15	85-100	80-100	65-100	45-90	20-40	NP-16
36B----- Alcona	0-9	Loamy fine sand	SM	A-2-4	0-8	95-100	90-100	70-95	15-35	<25	NP-4
	9-12	Loamy fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4	0-8	85-100	70-100	55-95	15-65	<30	NP-10
	12-42	Loamy fine sand, loamy very fine sand, very fine sandy loam.	SM, ML, SC, CL	A-4, A-2-4, A-1-b	0-8	85-100	70-100	35-75	15-65	<30	NP-10
	42-48	Sandy clay loam, silty clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0-8	95-100	90-100	55-90	45-85	25-40	5-20
	48-60	Stratified loamy very fine sand to silt loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0-8	95-100	90-100	60-95	25-85	<30	NP-7
37A----- Ingalls	0-12	Sand-----	SM, SP-SM	A-2, A-3, A-1	0-8	90-100	85-100	40-80	5-35	---	NP
	12-22	Loamy sand-----	SM, SP-SM	A-2, A-3,	0-8	90-100	85-100	40-80	10-35	---	NP
	22-60	Stratified silt to sand.	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	90-100	65-100	45-95	20-35	4-15
38----- Tonkey	0-7	Sandy loam-----	SM, SC, SM-SC	A-2, A-4	0	100	100	60-70	30-40	<28	NP-9
	7-12	Sandy loam, loamy sand.	SM, SM-SC, SC	A-2, A-4	0	100	100	50-75	15-40	<25	NP-9
	12-17	Loam, sandy clay loam.	CL-ML, SC, CL, SM-SC	A-4, A-6, A-2	0-2	95-100	85-100	50-90	30-75	20-35	5-14
	17-60	Stratified sand to silt loam.	SM, SM-SC, SP-SM, ML	A-2, A-1, A-3, A-4	0-2	95-100	85-100	40-80	5-80	<30	NP-11
39*. Pits											
42C*: Nester-----	0-8	Sandy loam, loam, fine sandy loam.	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	8-35	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	35-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
Mancelona-----	0-3	Sand-----	SP, SP-SM, SM	A-2, A-3, A-1-b	0-8	90-100	75-95	35-70	0-15	---	NP
	3-28	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2, A-1-b, A-3	0-8	80-100	55-95	30-75	5-30	---	NP
	28-39	Gravelly loamy sand, sandy clay loam, gravelly sandy loam.	SM-SC, SC, SP-SC	A-2, A-4, A-6, A-1	0-8	85-100	55-95	35-80	10-50	20-35	4-15
	39-68	Very gravelly sand, gravelly sand, sand.	GP, SP, GW, SW	A-1, A-2, A-3	0-8	40-90	30-85	20-60	0-15	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
43B----- East Lake	0-2	Sand-----	SM, SP-SM, SP	A-1, A-2-4, A-3	0-15	95-100	85-100	40-70	0-15	---	NP
	2-35	Sand, gravelly sand.	SM, SP-SM, SP	A-1, A-2-4, A-3	0-5	85-100	70-100	35-75	0-30	---	NP
	35-60	Stratified very gravelly coarse sand to gravelly sand.	GP, SP-SM, SP, GP-GM	A-1, A-3, A-2-4	0-5	40-90	25-80	20-55	0-10	---	NP
44B----- Croswell	0-10	Sand-----	SP-SM, SM, SP	A-3, A-2, A-1	0	90-100	85-100	40-70	0-25	---	NP
	10-30	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	90-100	85-100	40-75	0-30	<20	NP-4
	30-52	Sand-----	SP-SM, SM, SP	A-3, A-2, A-1	0	90-100	85-100	40-70	0-25	---	NP
	52-60	Stratified fine sand to silt loam.	CL, SC, SM-SC, CL-ML	A-6, A-4, A-2	0	100	90-100	65-95	20-90	20-35	4-15
45----- Wheatley	0-10	Mucky loamy sand	SM, SP-SM, SM-SC	A-2-4, A-1-b	0-5	90-100	75-100	35-75	10-30	<25	NP-7
	10-42	Gravelly sand, sand.	SM, SP-SM	A-2-4, A-1-b, A-3	0-5	80-95	65-90	30-70	5-15	<20	NP-4
	42-60	Sand, gravelly loamy sand, very gravelly sand.	GW, SW, GP, SP	A-1-b, A-2-4, A-3	5-10	20-80	20-60	20-60	0-20	<20	NP-4
46B, 46C, 46E, 46F----- Mancelona	0-3	Sand-----	SP, SP-SM, SM	A-2, A-3, A-1-b	0-8	90-100	75-95	35-70	0-15	---	NP
	3-28	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2, A-1-b, A-3	0-8	80-100	55-95	30-75	5-30	---	NP
	28-39	Gravelly loamy sand, sandy clay loam, gravelly sandy loam.	SM-SC, SC, SP-SC	A-2, A-4, A-6, A-1	0-8	85-100	55-95	35-80	10-50	20-35	4-15
	39-68	Very gravelly sand, gravelly sand, sand.	GP, SP, GW, SW	A-1, A-2, A-3	0-8	40-90	30-85	20-60	0-15	---	NP
47A----- Gladwin	0-9	Sand-----	SM, SP-SM	A-1-b, A-2-4, A-3	0-5	95-100	75-95	35-70	5-15	---	NP
	9-15	Sand, loamy sand	SM, SP-SM, SM-SC	A-1-b, A-2-4, A-3	0-5	95-100	75-95	35-70	5-30	<25	NP-5
	15-22	Gravelly loamy sand, sandy loam, gravelly sandy loam.	SM, SM-SC, SC	A-1-b, A-2-4	0-5	85-100	60-95	35-70	15-35	<30	NP-9
	22-60	Gravelly sand, sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-10	40-80	35-70	20-45	0-10	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
48----- Epoufette	0-7	Mucky sand-----	SM, SP, SP-SM	A-1, A-2, A-3	0-5	95-100	75-100	35-70	0-15	---	NP
	7-12	Loamy sand, sand, gravelly loamy sand.	SM, SP, SP-SM, SM-SC	A-2, A-3, A-1	0-5	85-100	65-95	30-70	0-25	<25	NP-7
	12-25	Gravelly sandy loam, sandy loam.	SM, SM-SC, SC	A-2, A-4, A-1	0-5	85-100	65-95	35-65	15-40	<30	2-10
	25-60	Gravelly sand, sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	50-90	45-85	30-65	0-25	---	NP
49A----- Colonville	0-11	Silt loam-----	ML, CL-ML, CL	A-4	0	100	100	85-100	60-90	<30	2-9
	11-60	Sandy loam, loamy sand, fine sand.	SM, SC	A-2, A-4, A-1, A-3	0-2	90-100	75-100	35-85	5-50	<30	NP-9
50B, 50C, 50D, 50E----- Menominee	0-8	Sand-----	SM, SP-SM	A-2-4, A-3	0-8	95-100	95-100	50-80	5-30	---	NP
	8-30	Sand, loamy sand	SP, SM, SP-SM	A-2-4, A-3, A-1-b	0-8	85-100	75-100	35-75	0-15	---	NP
	30-40	Clay loam, loam, sandy clay loam	CL, CL-ML	A-4, A-6	0-10	85-95	85-95	80-95	60-90	25-40	5-20
	40-60	Clay loam, loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-10	95-100	75-95	65-95	45-80	25-40	5-20
51B----- Iosco	0-9	Sand-----	SM, SP-SM	A-2-4, A-3, A-1-b	0-8	90-100	75-100	35-80	5-35	---	NP
	9-34	Loamy sand, sand, fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3, A-1-b	0-8	90-100	75-100	35-85	5-35	<25	NP-7
	34-37	Sandy loam, loam	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2	0-8	90-100	85-100	65-95	30-90	25-35	5-15
	37-60	Silty clay loam, clay loam.	CL, CL-ML	A-6, A-7	0-8	90-100	85-100	70-95	50-90	30-45	10-25
52----- Brevort	0-5	Mucky loamy sand	SP-SM, SM, SM-SC	A-1-b, A-2-4	0-8	85-100	75-100	35-75	10-30	<25	NP-7
	5-27	Sand, loamy sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3, A-1-b	0-8	85-100	75-100	35-85	5-35	<20	NP-7
	27-60	Silty loam, clay loam, silty clay loam.	CL, CL-ML, SM-SC	A-4, A-6, A-7	0-8	85-100	75-100	65-100	45-95	20-45	5-25
53B, 53C, 53D---- Manistee	0-11	Loamy sand-----	SM, SP-SM	A-2-4, A-4, A-1-b	0	95-100	90-100	45-85	10-45	---	NP
	11-21	Sand, loamy sand, fine sand.	SP-SM, SM	A-2-4, A-1-b, A-3	0-2	95-100	90-100	45-80	5-35	---	NP
	21-50	Clay, silty clay, clay loam.	CH, CL	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	50-60	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	70-95	40-65	20-40

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
54B----- Allendale	<u>In</u>										
	0-8	Loamy sand, sand	SM, SP-SM	A-2-4, A-1-b, A-4	0	95-100	90-100	45-80	10-40	---	NP
	8-20	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-4, A-1-b	0	95-100	90-100	45-80	5-40	---	NP
	20-60	Silty clay, clay, clay loam.	CH, MH	A-7	0	100	90-100	90-100	75-95	50-70	20-40
57A----- Belding	0-12	Sandy loam-----	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	85-100	55-85	25-55	<25	NP-6
	12-26	Sandy loam, fine sandy loam.	SM, SM-SC, ML	A-2, A-4	0	95-100	85-100	50-85	25-55	<30	2-7
	26-60	Clay loam, silty clay loam, loam.	CL	A-6	0-5	95-100	85-100	70-95	50-95	20-40	10-20
63----- Evart	0-14	Sand-----	SM, SP-SM, SM-SC	A-2, A-1, A-3	0-5	95-100	90-100	45-75	5-30	<25	NP-7
	14-60	Sand, loamy sand, gravelly sand.	SM, SP-SM, SM-SC, SP	A-1, A-3, A-2	0-5	95-100	60-100	30-75	0-30	<25	NP-7
64B, 64C----- Melita	0-2	Sand-----	SM, SP-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	---	NP
	2-52	Sand, loamy sand	SM, SP-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	---	NP
	52-60	Loam, clay loam, silty clay loam.	ML, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	75-100	55-95	25-45	4-15
65----- Arnheim	0-13	Silt loam-----	ML, CL-ML, SM, SM-SC	A-4	0	100	100	90-100	40-90	<25	NP-6
	13-60	Stratified silt loam to sand.	ML, SM, CL, SC	A-2-4, A-4, A-3	0	100	100	50-100	5-90	<30	NP-10
70----- Loxley	0-12	Peat-----	PT	A-8	0	---	---	---	---	---	---
	12-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
71----- Dawson	0-6	Peat-----	PT	A-8	0	---	---	---	---	---	---
	6-35	Sapric material	PT	A-8	0	---	---	---	---	---	---
	35-40	Loam-----	ML, CL-ML	A-4	0	100	100	90-100	50-90	<20	2-5
	40-60	Sand, fine sand, loamy fine sand.	SM-SC, SM, SC, SP-SM	A-2, A-3, A-1, A-4	0	45-100	35-100	15-90	0-45	<20	NP-10
74----- Cathro	0-19	Muck-----	PT	A-8	0	---	---	---	---	---	---
	19-30	Sapric material, muck.	PT	A-8	0	---	---	---	---	---	---
	30-60	Sandy loam, loam, silty clay loam.	SM-SC, CL-ML, SC, CL	A-4, A-6	0-5	80-100	65-100	60-100	35-90	20-40	4-20
76----- Lupton	0-4	Muck-----	PT	A-8	0	---	---	---	---	---	---
	4-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
77----- Tawas	0-7	Mucky peat-----	PT	A-8	0	---	---	---	---	---	---
	7-31	Sapric material	PT	A-8	0	---	---	---	---	---	---
	31-60	Sand, loamy sand, coarse sand.	SP, SM, SP-SM	A-3, A-2-4, A-4, A-1-b	0	80-100	60-100	30-80	0-40	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
78----- Rondeau	0-19	Muck-----	PT	A-8	0	---	---	---	---	---	NP
	19-60	Marl-----	OH, MH	A-8, A-5, A-7	0	100	95-100	80-90	60-80	50-90	NP-20
79----- Grousehaven	0-7	Muck-----	PT	A-8	0	---	---	---	---	---	NP
	7-60	Marl-----	OH, MH	A-8, A-5, A-7	0	100	95-100	80-90	60-80	50-90	NP-20
82B*, 82C*, 82D*, 82E*: Nester-----	0-8	Sandy loam, fine sandy loam, loam.	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	8-35	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	35-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
Manistee-----	0-11	Loamy sand-----	SM, SP-SM	A-2-4, A-4, A-1-b	0	95-100	90-100	45-85	10-45	---	NP
	11-21	Sand, loamy sand, fine sand.	SP-SM, SM	A-2-4, A-1-b, A-3	0-2	95-100	90-100	45-80	5-35	---	NP
	21-50	Clay, silty clay, clay loam.	CH, CL	A-7	0	95-100	90-100	85-100	75-95	40-65	20-40
	50-60	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	70-95	40-65	20-40
83B*, 83C*, 83E*: Rubicon-----	0-3	Sand-----	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	90-100	40-70	3-15	---	NP
	3-38	Sand-----	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	90-100	45-70	3-15	---	NP
	38-60	Sand-----	SP, SP-SM	A-2, A-3, A-1	0	95-100	90-100	45-70	0-10	---	NP
Menominee-----	0-8	Sand-----	SM, SP-SM	A-2-4, A-3	0-8	95-100	95-100	50-80	5-30	---	NP
	8-30	Sand, loamy sand, gravelly loamy sand.	SP, SM, SP-SM	A-2-4, A-3, A-1-b	0-8	85-100	60-100	30-75	0-15	---	NP
	30-40	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-10	85-95	85-95	80-95	60-90	25-40	5-20
	40-60	Clay loam, sandy clay loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-1, A-2	0-10	95-100	75-95	45-95	20-80	25-40	5-20
85B*: Kent-----	0-9	Sandy loam-----	SM, SM-SC, SC, ML	A-4, A-2	0-4	95-100	90-100	55-85	25-55	<30	NP-10
	9-23	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
	23-60	Clay, silty clay	CH	A-7	0-4	95-100	90-100	85-100	75-95	50-70	25-40
Selkirk-----	0-10	Loam-----	CL-ML, CL	A-4, A-6	0-5	90-100	85-100	70-100	50-90	25-40	5-20
	10-16	Clay, silty clay	CH	A-7	0-5	90-100	85-100	80-100	65-95	50-70	25-40
	16-60	Clay, silty clay	CH	A-7	0-5	90-100	85-100	80-100	65-95	50-70	25-40

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
86C*, 86D*, 86E*: Nester-----	0-4	Fine sandy loam, loam.	SM, SC, SM-SC, ML	A-2-4, A-4, A-1-b	0-5	90-100	75-100	45-85	20-55	<30	NP-10
	4-27	Clay loam, clay	CL, CH	A-7	0-5	90-100	75-100	75-100	55-95	40-55	20-30
	27-60	Clay loam, silty clay loam.	CL	A-7	0-5	90-100	75-100	70-100	50-95	40-50	15-25
Graycalm-----	0-2	Sand-----	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	75-100	35-55	0-15	---	NP
	2-44	Sand, loamy sand	SP-SM, SM, SP	A-3, A-2, A-1	0	95-100	75-100	30-75	0-30	---	NP
	44-76	Sand, loamy sand	SM, SP-SM, SP	A-2, A-1, A-3	0	95-100	75-100	30-75	0-30	---	NP
87C*, 87E*: Isabella-----	0-3	Loamy sand-----	SM, SP-SM	A-2, A-1	0-10	95-100	90-100	45-75	10-30	<20	NP-4
	3-12	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0-10	95-100	90-100	55-95	25-75	<30	NP-10
	12-24	Sandy loam, loam, sandy clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-10	95-100	90-100	55-95	25-75	20-40	5-20
	24-33	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-2, A-4, A-7	0-10	95-100	90-100	70-95	30-75	25-45	9-22
	33-60	Fine sandy loam, loam, clay loam.	SC, CL	A-6, A-4, A-7	0-10	95-100	90-100	65-95	35-75	25-45	7-22
Melita-----	0-2	Sand-----	SM, SP-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-70	5-15	---	NP
	2-52	Sand, loamy sand	SM, SP-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	---	NP
	52-60	Loam, clay loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0-5	95-100	90-100	75-100	55-95	25-45	4-15
90C*: Rubicon-----	0-3	Sand-----	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	3-38	Sand-----	SM, SP-SM, SP	A-2, A-3, A-1	0	95-100	75-100	35-70	0-15	---	NP
	38-60	Sand-----	SP, SP-SM, SM	A-1, A-2, A-3	0	95-100	75-100	30-70	0-15	---	NP
Montcalm-----	0-6	Loamy sand-----	SM, SP-SM	A-2, A-1	0-2	90-100	75-100	35-75	10-30	---	NP
	6-30	Loamy sand, sand	SM, SP-SM	A-2, A-1, A-3	0-2	90-100	75-100	35-75	5-30	---	NP
	30-60	Stratified sand to sandy clay loam.	SM, SP-SM, SM-SC, SC	A-2, A-4, A-1, A-3	0-2	90-100	75-100	35-85	5-50	<30	NP-10
93C*, 93D*, 93E*: Klacking-----	0-2	Sand-----	SP-SM, SM, SP	A-2, A-1, A-3	0-5	90-100	75-100	35-75	0-15	---	NP
	2-34	Sand, loamy sand	SP-SM, SM, SP	A-2, A-1, A-3	0-5	90-100	75-100	35-75	0-30	---	NP
	34-82	Sand, loamy sand, sandy loam.	SP-SM, SM, SP, SM-SC	A-2, A-4, A-1, A-3	0-5	90-100	75-100	35-70	0-40	<25	NP-7

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
93C*, 93D*, 93E*: Isabella-----	In										
	0-3	Loamy sand-----	SM, SP-SM	A-2, A-1	0-10	95-100	90-100	45-75	10-30	<20	NP-4
	3-12	Sandy loam, fine sandy loam, loam.	CL, SC, ML, SM	A-6, A-2, A-4	0-10	95-100	90-100	55-95	25-75	<30	NP-11
	12-24	Sandy loam, loam, sandy clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-10	95-100	90-100	55-95	25-75	20-40	5-20
	24-33	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-2, A-4, A-7	0-10	95-100	90-100	70-95	30-75	25-45	9-22
94B*, 94C*, 94E*: Isabella-----	33-60	Fine sandy loam, loam, clay loam.	SC, CL	A-6, A-4, A-7	0-10	95-100	90-100	65-95	35-75	25-45	7-22
	0-3	Loamy sand-----	SM, SP-SM	A-2, A-1	0-10	95-100	90-100	45-75	10-30	<20	NP-4
	3-12	Sandy loam, fine sandy loam, loam.	CL, SC, ML, SM	A-6, A-2, A-4	0-10	95-100	90-100	55-95	25-75	<30	NP-11
	12-24	Sandy loam, loam, sandy clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-10	95-100	90-100	55-95	25-75	20-40	5-20
	24-33	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-2, A-4, A-7	0-10	95-100	90-100	70-95	30-75	25-45	9-22
Montcalm-----	33-60	Fine sandy loam, loam, clay loam.	SC, CL	A-6, A-4, A-7	0-10	95-100	90-100	65-95	35-75	25-45	7-22
	0-6	Loamy sand-----	SM, SP-SM	A-2, A-1	0-2	90-100	75-100	35-75	10-30	---	NP
	6-30	Loamy sand, sand	SM, SP-SM	A-2, A-1, A-3	0-2	90-100	75-100	35-75	5-30	---	NP
97B*, 97C*: Isabella-----	30-60	Stratified sand to sandy clay loam.	SM, SP-SM, SM-SC, SC	A-2, A-4, A-1, A-3	0-2	90-100	75-100	35-85	5-50	<30	NP-10
	0-3	Loamy sand-----	SM, SP-SM	A-2, A-1	0-10	95-100	90-100	45-75	10-30	<20	NP-4
	3-12	Sandy loam, fine sandy loam, loam.	CL, SC, ML, SM	A-6, A-2, A-4	0-10	95-100	90-100	55-95	25-75	<30	NP-11
	12-24	Sandy loam, loam, sandy clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-10	95-100	90-100	55-95	25-75	20-40	5-20
	24-33	Sandy clay loam, clay loam, loam.	SC, CL	A-6, A-2, A-4, A-7	0-10	95-100	90-100	70-95	30-75	25-45	9-22
Melita-----	33-60	Fine sandy loam, loam, clay loam.	SC, CL	A-6, A-4, A-7	0-10	95-100	90-100	65-95	35-75	25-45	7-22
	0-2	Sand-----	SM, SP-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	---	NP
	2-52	Sand, loamy sand	SM, SP-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	---	NP
	52-60	Loam, clay loam, silty clay loam.	ML, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	75-100	55-95	25-45	4-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
10B, 10C, 10E----	0-5	0-10	1.30-1.65	6.0-20	0.07-0.09	3.6-5.5	Low-----	0.15	5	1	---
Grayling	5-30	0-10	1.30-1.65	6.0-20	0.06-0.08	3.6-5.5	Low-----	0.15			
	30-68	0-10	1.45-1.65	6.0-20	0.04-0.06	4.5-6.5	Low-----	0.15			
11B, 11C, 11E, 11F-----	0-3	0-5	1.35-1.55	6.0-20	0.05-0.09	4.5-6.0	Low-----	0.15	5	1	.5-1
Rubicon	3-38	0-10	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low-----	0.15			
	38-60	0-5	1.40-1.65	6.0-20	0.04-0.06	4.5-6.5	Low-----	0.15			
12B-----	0-11	0-10	1.30-1.55	6.0-20	0.06-0.09	3.6-6.5	Low-----	0.15	5	1	.5-2
Croswell	11-21	0-10	1.40-1.60	6.0-20	0.06-0.10	4.5-7.3	Low-----	0.15			
	21-65	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-8.4	Low-----	0.15			
13A-----	0-8	0-8	1.30-1.55	6.0-20	0.07-0.10	3.6-7.3	Low-----	0.15	5	1	.5-3
Au Gres	8-31	1-15	1.50-1.70	6.0-20	0.06-0.09	4.5-7.3	Low-----	0.15			
	31-60	0-8	1.50-1.70	6.0-20	0.05-0.07	5.1-7.3	Low-----	0.15			
14-----	0-5	0-10	0.90-1.60	6.0-20	0.07-0.18	5.6-7.8	Low-----	0.15	5	1	4-15
Roscommon	5-60	0-10	1.45-1.70	6.0-20	0.05-0.09	5.6-8.4	Low-----	0.17			
17B, 17C, 17E----	0-2	0-10	1.30-1.55	6.0-20	0.04-0.10	4.5-6.5	Low-----	0.15	5	1	.5-2
Graycalm	2-44	0-15	1.25-1.60	6.0-20	0.05-0.10	4.5-7.3	Low-----	0.15			
	44-76	0-10	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----	0.15			
18B, 18C, 18E----	0-2	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-6.0	Low-----	0.15	5	1	1-2
Klackung	2-34	0-10	1.35-1.65	6.0-20	0.05-0.08	4.5-7.3	Low-----	0.15			
	34-82	2-15	1.55-1.70	2.0-6.0	0.05-0.11	4.5-7.3	Low-----	0.17			
20B, 20C, 20E----	0-6	2-10	1.35-1.60	2.0-6.0	0.09-0.12	4.5-6.5	Low-----	0.17	5	2	.5-3
Montcalm	6-30	8-15	1.30-1.60	2.0-6.0	0.05-0.10	5.1-6.5	Low-----	0.17			
	30-60	2-22	1.45-1.65	2.0-6.0	0.04-0.16	5.1-7.3	Low-----	0.17			
21*: Histosols.											
Aquents.											
22B-----	0-8	5-20	1.25-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low-----	0.24	3	3	1-3
Nester	8-35	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	35-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			
22B2-----	0-8	7-27	1.25-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low-----	0.32	3	5	1-3
Nester	8-31	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	31-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			
22C-----	0-8	5-20	1.25-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low-----	0.24	3	3	1-3
Nester	8-35	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	35-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			
22C2-----	0-8	7-27	1.25-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low-----	0.32	3	5	1-3
Nester	8-31	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	31-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			
22D-----	0-8	5-20	1.25-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low-----	0.24	3	3	1-3
Nester	8-35	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	35-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
22D2----- Nester	0-8	7-27	1.25-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low-----	0.32	3	5	1-3
	8-31	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	31-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			
22D3----- Nester	0-8	27-40	1.45-1.65	0.2-0.6	0.17-0.19	5.1-7.3	Moderate----	0.32	2	4	.5-1
	8-29	35-45	1.50-1.65	0.06-0.2	0.15-0.19	5.1-7.3	Moderate----	0.32			
	29-60	30-40	1.55-1.70	0.06-0.2	0.14-0.16	7.9-8.4	Moderate----	0.32			
22E, 22F----- Nester	0-8	5-20	1.25-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low-----	0.24	3	3	1-3
	8-31	35-45	1.50-1.75	0.06-0.2	0.10-0.20	5.1-7.3	Moderate----	0.32			
	31-60	30-40	1.55-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate----	0.32			
23B----- Kawkawlin	0-9	8-27	1.45-1.60	0.6-2.0	0.20-0.22	5.1-7.3	Low-----	0.32	3	5	2-4
	9-31	35-45	1.45-1.60	0.06-0.2	0.10-0.20	5.1-7.8	Moderate----	0.32			
	31-60	30-40	1.50-1.60	0.06-0.2	0.13-0.20	7.4-8.4	Moderate----	0.32			
24----- Sims	0-6	18-27	1.35-1.55	0.6-2.0	0.20-0.22	6.1-7.8	Low-----	0.24	3	5	3-10
	6-17	35-40	1.40-1.70	0.06-0.2	0.12-0.20	6.1-7.8	Moderate----	0.37			
	17-60	35-40	1.50-1.75	0.06-0.2	0.14-0.20	7.4-8.4	Moderate----	0.37			
25B----- Kent	0-9	12-20	1.50-1.70	2.0-6.0	0.14-0.18	5.6-7.3	Low-----	0.24	3	3	1-3
	9-23	45-60	1.55-1.65	0.06-0.2	0.09-0.13	5.6-7.8	High-----	0.28			
	23-60	45-60	1.55-1.65	0.06-0.2	0.08-0.12	7.4-8.4	High-----	0.28			
25B2----- Kent	0-8	18-27	1.50-1.70	0.6-2.0	0.20-0.24	5.6-7.3	Moderate----	0.37	3	6	1-3
	8-17	45-60	1.55-1.65	0.06-0.2	0.09-0.13	5.6-7.8	High-----	0.28			
	17-60	45-60	1.55-1.65	0.06-0.2	0.08-0.12	7.4-8.4	High-----	0.28			
25C----- Kent	0-9	12-20	1.50-1.70	2.0-6.0	0.14-0.18	5.6-7.3	Low-----	0.24	3	3	1-3
	9-23	45-60	1.55-1.65	0.06-0.2	0.09-0.13	5.6-7.8	High-----	0.28			
	23-60	45-60	1.55-1.65	0.06-0.2	0.08-0.12	7.4-8.4	High-----	0.28			
25C2----- Kent	0-8	18-27	1.50-1.70	0.6-2.0	0.20-0.24	5.6-7.3	Moderate----	0.37	3	6	1-3
	8-17	45-60	1.55-1.65	0.06-0.2	0.09-0.13	5.6-7.8	High-----	0.28			
	17-60	45-60	1.55-1.65	0.06-0.2	0.08-0.12	7.4-8.4	High-----	0.28			
25D----- Kent	0-9	12-20	1.50-1.70	2.0-6.0	0.14-0.18	5.6-7.3	Low-----	0.24	3	3	1-3
	9-23	45-60	1.55-1.65	0.06-0.2	0.09-0.13	5.6-7.8	High-----	0.28			
	23-60	45-60	1.55-1.65	0.06-0.2	0.08-0.12	7.4-8.4	High-----	0.28			
26B----- Selkirk	0-10	15-27	1.30-1.60	0.6-2.0	0.18-0.24	5.6-7.8	Low-----	0.37	3	5	3-4
	10-16	45-60	1.40-1.60	0.06-0.2	0.08-0.13	5.6-7.8	High-----	0.28			
	16-60	45-60	1.40-1.60	0.06-0.2	0.07-0.12	7.4-8.4	High-----	0.28			
27----- Pickford	0-9	27-40	1.10-1.35	0.2-0.6	0.20-0.24	5.1-7.8	Moderate----	0.43	3	7	10-15
	9-30	40-60	1.40-1.65	<0.06	0.09-0.13	5.1-7.8	Moderate----	0.32			
	30-60	40-60	1.50-1.70	<0.06	0.08-0.12	7.4-8.4	Moderate----	0.32			
28. Udorthents											
29. Udipsamments											
30B, 30C, 30D, 30E----- Isabella	0-3	3-10	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17	5	2	1-3
	3-12	7-20	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17			
	12-24	12-30	1.40-1.60	0.6-2.0	0.10-0.18	5.6-7.3	Moderate----	0.32			
	24-33	18-35	1.40-1.70	0.6-2.0	0.15-0.18	5.6-7.3	Moderate----	0.32			
	33-60	15-35	1.45-1.70	0.6-2.0	0.11-0.18	7.4-8.4	Moderate----	0.32			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
32----- Angelica	0-5 5-13 13-60	10-20 18-35 5-20	1.15-1.60 1.50-1.80 1.45-1.95	0.6-2.0 0.2-0.6 0.2-0.6	0.18-0.22 0.10-0.20 0.10-0.20	6.1-7.3 6.1-7.8 7.4-8.4	Low----- Moderate---- Low-----	0.32 0.32 0.32	5	5	2-12
36B----- Alcona	0-9 9-12 12-42 42-48 48-60	2-15 5-20 5-18 10-20 5-18	1.30-1.60 1.35-1.70 1.35-1.70 1.35-1.70 1.35-1.70	0.6-6.0 0.6-6.0 0.6-6.0 0.6-2.0 0.6-2.0	0.10-0.14 0.10-0.17 0.08-0.17 0.13-0.20 0.08-0.20	4.5-7.3 4.5-7.3 5.1-7.8 5.1-7.8 5.1-8.4	Low----- Low----- Low----- Low----- Low-----	0.17 0.17 0.17 0.24 0.24	5	2	1-3
37A----- Ingalls	0-12 12-22 22-60	0-5 3-15 2-25	1.25-1.40 1.35-1.45 1.45-1.80	6.0-20 6.0-20 0.2-0.6	0.05-0.10 0.05-0.10 0.09-0.22	5.1-7.3 5.1-7.3 5.6-8.4	Low----- Low----- Low-----	0.15 0.17 0.43	5	1	.5-3
38----- Tonkey	0-7 7-12 12-17 17-60	8-18 8-18 10-24 0-20	1.10-1.60 1.30-1.80 1.30-1.80 1.80-1.95	2.0-6.0 2.0-6.0 2.0-6.0 2.0-6.0	0.13-0.15 0.10-0.15 0.12-0.20 0.05-0.19	5.6-7.8 5.6-7.8 5.6-8.4 7.4-8.4	Low----- Low----- Low----- Low-----	0.24 0.24 0.24 0.24	4	3	4-7
39*. Pits											
42C*: Nester-----	0-8 8-35 35-60	5-20 35-45 30-40	1.25-1.60 1.50-1.75 1.55-1.70	2.0-6.0 0.06-0.2 0.06-0.2	0.13-0.15 0.10-0.20 0.14-0.20	5.1-7.3 5.1-7.3 7.9-8.4	Low----- Moderate---- Moderate----	0.24 0.32 0.32	3	3	1-3
Mancelona-----	0-3 3-28 28-39 39-68	0-5 2-15 10-25 0-10	1.35-1.65 1.30-1.65 1.30-1.65 1.45-1.65	6.0-20 6.0-20 2.0-6.0 >20	0.06-0.09 0.06-0.12 0.06-0.16 0.02-0.04	5.1-7.3 5.6-7.8 6.1-7.8 7.4-8.4	Low----- Low----- Low----- Low-----	0.15 0.17 0.17 0.10	4	1	.5-2
43B----- East Lake	0-2 2-35 35-60	0-8 0-10 0-10	1.30-1.60 1.30-1.60 1.50-1.65	6.0-20 6.0-20 >20	0.05-0.09 0.07-0.10 0.02-0.06	5.1-7.3 5.1-7.3 7.4-8.4	Low----- Low----- Low-----	0.15 0.15 0.10	4	1	.5-2
44B----- Croswell	0-10 10-30 30-52 52-60	0-5 0-10 0-5 10-25	1.35-1.75 1.35-1.75 1.45-1.70 1.30-1.90	6.0-20 6.0-20 6.0-20 0.2-0.6	0.06-0.09 0.06-0.10 0.04-0.06 0.05-0.21	4.5-6.0 5.1-6.5 5.1-6.5 5.1-7.8	Low----- Low----- Low----- Low-----	0.15 0.15 0.15 0.24	5	1	.5-1
45----- Wheatley	0-10 10-42 42-60	5-15 2-10 0-10	0.90-1.30 1.45-1.70 1.55-1.70	2.0-6.0 6.0-20 >20	0.12-0.15 0.06-0.08 0.02-0.04	6.1-7.8 6.1-7.8 7.4-8.4	Low----- Low----- Low-----	0.17 0.15 0.10	3	2	10-15
46B, 46C, 46E, 46F----- Mancelona	0-3 3-28 28-39 39-68	0-5 2-15 10-25 0-10	1.35-1.65 1.30-1.65 1.30-1.65 1.45-1.65	6.0-20 6.0-20 2.0-6.0 >20	0.06-0.09 0.06-0.12 0.06-0.16 0.02-0.04	5.1-7.3 5.6-7.8 6.1-7.8 7.4-8.4	Low----- Low----- Low----- Low-----	0.15 0.17 0.17 0.10	4	1	.5-2
47A----- Gladwin	0-9 9-15 15-22 22-60	0-8 2-15 5-18 0-5	1.30-1.60 1.35-1.65 1.35-1.65 1.35-1.60	6.0-20 6.0-20 2.0-6.0 >20	0.06-0.10 0.05-0.11 0.05-0.13 0.02-0.04	5.1-7.8 5.1-7.8 5.6-7.8 7.4-8.4	Low----- Low----- Low----- Low-----	0.15 0.17 0.17 0.10	4	1	2-3
48----- Epoufette	0-7 7-12 12-25 25-60	0-5 5-15 8-18 0-8	1.35-1.50 1.40-1.55 1.40-1.60 1.40-1.65	6.0-20 6.0-20 2.0-6.0 >20	0.05-0.10 0.05-0.07 0.08-0.14 0.01-0.03	6.1-7.3 6.1-7.3 6.6-7.8 7.4-8.4	Low----- Low----- Low----- Low-----	0.15 0.17 0.17 0.10	4	1	4-6

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
49A----- Colonville	0-11 11-60	7-18 0-18	1.35-1.45 1.40-1.65	2.0-6.0 2.0-20	0.20-0.22 0.02-0.12	6.6-8.4 7.9-8.4	Low----- Low-----	0.20 0.15	3	5	2-4
50B, 50C, 50D, 50E----- Menominee	0-8 8-30 30-40 40-60	0-10 5-15 18-35 12-35	1.35-1.65 1.30-1.70 1.45-1.70 1.45-1.70	6.0-20 6.0-20 0.2-0.6 0.2-0.6	0.08-0.10 0.04-0.10 0.14-0.18 0.13-0.18	4.5-6.5 4.5-7.8 5.1-7.8 6.1-8.4	Low----- Low----- Moderate----- Moderate-----	0.15 0.17 0.32 0.32	5	1	2-4
51B----- Iosco	0-9 9-34 34-37 37-60	0-10 0-15 18-27 27-35	1.25-1.40 1.35-1.60 1.50-1.70 1.50-1.70	6.0-20 6.0-20 0.2-0.6 0.2-0.6	0.07-0.09 0.06-0.11 0.16-0.20 0.17-0.20	5.1-6.5 5.1-7.3 6.1-7.8 6.6-8.4	Low----- Low----- Moderate----- Moderate-----	0.15 0.17 0.37 0.37	5	1	1-4
52----- Brevort	0-5 5-27 27-60	2-15 2-15 10-35	0.90-1.30 1.40-1.55 1.45-1.80	2.0-6.0 2.0-20 0.2-0.6	0.12-0.17 0.05-0.11 0.14-0.22	6.1-7.8 6.1-7.8 7.4-8.4	Low----- Low----- Moderate-----	0.17 0.17 0.43	5	2	10-15
53B, 53C, 53D----- Manistee	0-11 11-21 21-50 50-60	3-12 2-12 35-60 40-60	1.35-1.60 1.35-1.60 1.50-1.70 1.60-1.75	6.0-20 6.0-20 <0.06 0.06-0.2	0.10-0.12 0.06-0.10 0.08-0.12 0.08-0.16	4.5-7.3 5.1-7.3 5.1-7.8 6.6-8.4	Low----- Low----- High----- High-----	0.17 0.17 0.32 0.32	4	2	2-4
54B----- Allendale	0-8 8-20 20-60	0-12 0-15 40-60	1.25-1.40 1.35-1.45 1.45-1.70	6.0-20 6.0-20 0.06-0.2	0.09-0.12 0.06-0.10 0.08-0.12	4.5-7.3 4.5-7.3 6.1-8.4	Low----- Low----- Moderate-----	0.17 0.17 0.32	4	2	1-3
57A----- Belding	0-12 12-26 26-60	2-12 5-15 10-30	1.30-1.70 1.40-1.80 1.50-1.90	2.0-6.0 2.0-6.0 0.2-0.6	0.12-0.15 0.11-0.14 0.14-0.20	5.1-7.3 5.1-7.8 7.4-8.4	Low----- Low----- Moderate-----	0.24 0.24 0.32	5	3	1-2
63----- Ewart	0-14 14-60	0-15 0-15	1.35-1.50 1.40-1.65	6.0-20 6.0-20	0.06-0.12 0.05-0.10	6.1-7.8 6.1-8.4	Low----- Low-----	0.15 0.15	5	1	1-6
64B, 64C----- Melita	0-2 2-52 52-60	0-10 0-15 18-35	1.35-1.60 1.35-1.60 1.45-1.70	6.0-20 6.0-20 0.2-0.6	0.06-0.08 0.04-0.10 0.14-0.19	3.6-7.3 5.1-7.3 6.1-7.3	Low----- Low----- Low-----	0.15 0.17 0.32	5	1	3-4
65----- Arnheim	0-13 13-60	12-18 5-18	1.15-1.60 1.50-1.80	0.6-6.0 0.6-2.0	0.12-0.35 0.05-0.22	5.1-8.4 5.1-8.4	Low----- Low-----	0.37 0.37	5	8	2-4
70----- Loxley	0-12 12-60	--- ---	0.30-0.40 0.10-0.35	>6.0 0.2-6.0	0.35-0.65 0.35-0.45	<4.5 <5.0	----- -----	----- -----	5	7	70-90
71----- Dawson	0-6 6-35 35-40 40-60	--- --- 10-15 0-10	0.15-0.30 0.15-0.40 1.55-1.75 1.55-1.75	>6.0 0.2-6.0 0.6-2.0 6.0-20	0.55-0.65 0.35-0.45 0.18-0.20 0.03-0.10	3.6-4.4 3.6-4.4 3.6-5.5 4.5-6.5	----- ----- Low----- Low-----	----- ----- ----- -----	4	7	65-85
74----- Cathro	0-19 19-30 30-60	--- --- 10-30	0.28-0.45 0.15-0.30 1.50-1.70	0.2-6.0 0.2-6.0 0.2-2.0	0.45-0.55 0.35-0.45 0.11-0.22	4.5-7.8 4.5-7.8 5.6-8.4	----- ----- Low-----	----- ----- -----	5	2	60-85
76----- Lupton	0-4 4-60	--- ---	0.10-0.35 0.10-0.35	0.2-6.0 0.2-6.0	0.35-0.45 0.35-0.45	5.6-7.8 5.6-7.8	----- -----	----- -----	5	2	70-90
77----- Tawas	0-7 7-31 31-60	--- --- 0-10	0.30-0.55 0.30-0.55 1.40-1.65	0.2-6.0 0.2-6.0 6.0-20	0.35-0.45 0.35-0.45 0.03-0.10	4.5-7.8 4.5-7.8 5.6-8.4	----- ----- Low-----	----- ----- 0.15	4	5	40-60

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
78----- Rondeau	0-19 19-60	0-10 5-15	0.10-0.25 0.05-0.20	0.2-6.0 <0.2	0.35-0.48 0.20-0.22	5.1-7.8 7.4-7.8	----- -----	----- -----	5	2	>25
79----- Grousehaven	0-7 7-60	--- ---	0.10-0.25 0.05-0.20	0.2-6.0 <0.2	0.35-0.45 0.20-0.22	7.4-8.4 7.4-8.4	Low----- Low-----	----- -----	---	2	>25
82B*, 82C*, 82D*, 82E*: Nester-----	0-8 8-35 35-60	5-20 35-45 30-40	1.25-1.60 1.50-1.75 1.55-1.70	2.0-6.0 0.06-0.2 0.06-0.2	0.13-0.15 0.10-0.20 0.14-0.20	5.1-7.3 5.1-7.3 7.9-8.4	Low----- Moderate----- Moderate-----	0.24 0.32 0.32	3	3	1-3
Manistee-----	0-11 11-21 21-50 50-60	3-12 2-12 35-60 35-60	1.35-1.60 1.35-1.60 1.50-1.70 1.60-1.75	6.0-20 6.0-20 <0.06 0.06-0.2	0.10-0.12 0.06-0.10 0.08-0.12 0.08-0.16	4.5-7.3 5.1-7.3 5.1-7.3 6.6-8.4	Low----- Low----- High----- High-----	0.17 0.17 0.32 0.32	4	2	2-4
83B*, 83C*, 83E*: Rubicon-----	0-3 3-38 38-60	0-5 0-10 0-10	1.20-1.45 1.30-1.45 1.40-1.55	6.0-20 6.0-20 6.0-20	0.05-0.09 0.06-0.08 0.04-0.06	4.5-6.0 4.5-6.0 5.1-6.5	Low----- Low----- Low-----	0.15 0.15 0.15	5	1	.5-1
Menominee-----	0-8 8-30 30-40 40-60	0-10 5-15 18-35 12-35	1.35-1.65 1.30-1.70 1.45-1.70 1.45-1.70	6.0-20 6.0-20 0.2-0.6 0.2-0.6	0.08-0.10 0.04-0.10 0.14-0.18 0.13-0.18	4.5-6.5 4.5-7.8 5.1-7.8 6.1-8.4	Low----- Low----- Moderate----- Moderate-----	0.15 0.17 0.32 0.32	5	1	2-4
85B*: Kent-----	0-9 9-23 23-60	12-20 45-60 45-60	1.50-1.70 1.55-1.65 1.55-1.65	2.0-6.0 0.06-0.2 0.06-0.2	0.14-0.18 0.09-0.13 0.08-0.12	5.6-7.3 5.6-7.8 7.4-8.4	Low----- High----- High-----	0.24 0.28 0.28	3	3	1-3
Selkirk-----	0-10 10-16 16-60	15-27 45-60 45-60	1.30-1.60 1.40-1.60 1.40-1.60	0.6-2.0 0.06-0.2 0.06-0.2	0.18-0.24 0.08-0.13 0.07-0.12	5.6-7.3 5.6-7.3 7.4-8.4	Low----- High----- High-----	0.37 0.28 0.28	3	5	3-4
86C*, 86D*, 86E*: Nester-----	0-4 4-27 27-60	5-20 35-45 30-40	1.25-1.60 1.50-1.75 1.55-1.70	2.0-6.0 0.06-0.2 0.06-0.2	0.13-0.15 0.10-0.20 0.14-0.20	5.1-7.3 5.1-7.3 7.9-8.4	Low----- Moderate----- Moderate-----	0.24 0.32 0.32	3	3	1-3
Graycalm-----	0-2 2-44 44-76	0-10 0-15 0-10	1.30-1.55 1.25-1.60 1.50-1.65	6.0-20 6.0-20 6.0-20	0.04-0.10 0.05-0.10 0.04-0.09	4.5-6.5 4.5-7.3 4.5-7.3	Low----- Low----- Low-----	0.15 0.15 0.15	5	1	.5-2
87C*, 87E*: Isabella-----	0-3 3-12 12-24 24-33 33-60	10-15 7-20 12-30 18-35 15-35	1.35-1.55 1.35-1.55 1.40-1.60 1.40-1.70 1.45-1.70	0.6-2.0 2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0	0.12-0.16 0.11-0.17 0.10-0.18 0.15-0.18 0.11-0.18	4.5-6.5 4.5-6.5 5.6-7.3 5.6-7.3 7.4-8.4	Low----- Low----- Moderate----- Moderate----- Moderate-----	0.24 0.24 0.32 0.32 0.32	5	3	1-3
Melita-----	0-2 2-52 52-60	0-10 0-15 18-35	1.35-1.60 1.35-1.60 1.45-1.70	6.0-20 6.0-20 0.2-0.6	0.06-0.08 0.04-0.10 0.14-0.19	3.6-7.3 5.1-7.3 6.1-7.3	Low----- Low----- Low-----	0.15 0.17 0.32	5	1	1-3
90C*: Rubicon-----	0-3 3-38 38-60	0-5 0-10 0-5	1.35-1.55 1.30-1.60 1.40-1.65	6.0-20 6.0-20 6.0-20	0.05-0.09 0.04-0.08 0.04-0.06	4.5-6.0 4.5-6.0 4.5-6.5	Low----- Low----- Low-----	0.15 0.15 0.15	5	1	.5-1

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
90C*: Montcalm-----	0-6	2-10	1.35-1.60	2.0-6.0	0.09-0.12	5.1-6.5	Low-----	0.17	5	2	.5-3
	6-30	8-15	1.30-1.60	2.0-6.0	0.05-0.10	5.1-6.5	Low-----	0.17			
	30-60	2-22	1.45-1.65	2.0-6.0	0.04-0.16	5.1-6.5	Low-----	0.17			
93C*, 93D*, 93E*: Klackang-----	0-2	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-6.0	Low-----	0.15	5	1	1-2
	2-34	0-10	1.35-1.65	6.0-20	0.05-0.08	4.5-7.3	Low-----	0.15			
	34-82	2-15	1.55-1.70	2.0-6.0	0.05-0.11	4.5-7.3	Low-----	0.17			
Isabella-----	0-3	3-10	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17	5	2	1-3
	3-12	7-20	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17			
	12-24	12-30	1.40-1.60	0.6-2.0	0.10-0.18	5.6-7.3	Moderate----	0.32			
	24-33	18-35	1.40-1.70	0.6-2.0	0.15-0.18	5.6-7.3	Moderate----	0.32			
	33-60	15-35	1.45-1.70	0.6-2.0	0.11-0.18	7.4-8.4	Moderate----	0.32			
94B*, 94C*, 94E*: Isabella-----	0-3	3-10	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17	5	2	1-3
	3-12	7-20	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17			
	12-24	12-30	1.40-1.60	0.6-2.0	0.10-0.18	5.6-7.3	Moderate----	0.32			
	24-33	18-35	1.40-1.70	0.6-2.0	0.15-0.18	5.6-7.3	Moderate----	0.32			
	33-60	15-35	1.45-1.70	0.6-2.0	0.11-0.18	7.4-8.4	Moderate----	0.32			
Montcalm-----	0-6	2-10	1.35-1.60	2.0-6.0	0.09-0.12	5.1-6.5	Low-----	0.17	5	2	.5-3
	6-30	8-15	1.30-1.60	2.0-6.0	0.05-0.10	5.1-6.5	Low-----	0.17			
	30-60	2-22	1.45-1.65	2.0-6.0	0.04-0.16	5.1-6.5	Low-----	0.17			
97B*, 97C*: Isabella-----	0-3	3-10	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17	5	2	1-3
	3-12	7-20	1.35-1.55	2.0-6.0	0.08-0.10	4.5-6.5	Low-----	0.17			
	12-24	12-30	1.40-1.60	0.6-2.0	0.10-0.18	5.6-7.3	Moderate----	0.32			
	24-33	18-35	1.40-1.70	0.6-2.0	0.15-0.18	5.6-7.3	Moderate----	0.32			
	33-60	15-35	1.45-1.70	0.6-2.0	0.11-0.18	7.4-8.4	Moderate----	0.32			
Melita-----	0-2	0-10	1.35-1.60	6.0-20	0.06-0.08	3.5-7.3	Low-----	0.15	5	1	3-4
	2-52	0-15	1.35-1.60	6.0-20	0.04-0.10	5.1-7.3	Low-----	0.17			
	52-60	18-35	1.45-1.70	0.2-0.6	0.14-0.19	6.1-7.3	Low-----	0.32			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months			Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
10B, 10C, 10E----- Grayling	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
11B, 11C, 11E, 11F----- Rubicon	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	High.
12B----- Croswell	A	None-----	---	---	2.0-4.0	Apparent	Nov-May	---	Low-----	Low-----	Moderate.
13A----- Au Gres	B	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	Moderate	Low-----	Moderate.
14----- Roscommon	A/D	None-----	---	---	+1-1.0	Apparent	Sep-Jun	---	Moderate	High-----	Low.
17B, 17C, 17E----- Graycalm	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
18B, 18C, 18E----- Klackling	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
20B, 20C, 20E----- Montcalm	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
21*: Histosols. Aquents.											
22B, 22B2, 22C, 22C2, 22D, 22D2, 22D3, 22E, 22F--- Nester	C	None-----	---	---	>6.0	---	---	---	Moderate	High-----	Low.
23B----- Kawkawlin	C	None-----	---	---	1.0-2.0	Apparent	Oct-May	---	High-----	High-----	Low.
24----- Sims	D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
25B, 25B2----- Kent	D	None-----	---	---	2.0-3.0	Perched	Nov-Apr	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months			Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
25C, 25C2, 25D--- Kent	D	None-----	---	---	>6.0	---	---	---	Moderate	High-----	Low.
26B----- Selkirk	C	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	High-----	High-----	Low.
27----- Pickford	D	None-----	---	---	+1-1.0	Perched	Nov-Jun	---	Moderate	High-----	Low.
28. Udorthents											
29. Udipsamments											
30B, 30C, 30D, 30E----- Isabella	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.
32----- Angelica	B/D	None-----	---	---	+1-1.0	Apparent	Oct-Jun	---	High-----	High-----	Low.
36B----- Alcona	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Low.
37A----- Ingalls	B	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	Moderate	Moderate	Moderate.
38----- Tonkey	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
39*. Pits											
42C*: Nester-----	C	None-----	---	---	>6.0	---	---	---	Moderate	High-----	Low.
Mancelona-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Low.
43B----- East Lake	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
44B----- Croswell	A	None-----	---	---	2.5-5.0	Perched	Nov-May	---	Low-----	Low-----	Moderate.
45----- Wheatley	A/D	None-----	---	---	+1-1.0	Apparent	Oct-May	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Total		Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
46B, 46C, 46E, 46F----- Mancelona	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Low.
47A----- Gladwin	A	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	Moderate	Low-----	Low.
48----- Epoufette	B/D	None-----	---	---	+1-1.0	Apparent	Nov-Jun	---	High-----	High-----	Moderate.
49A----- Colonville	C	Frequent----	Brief-----	Dec-May	1.0-2.0	Apparent	Sep-May	---	High-----	Low-----	Low.
50B, 50C, 50D, 50E----- Menominee	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
51B----- Iosco	B	None-----	---	---	0.5-1.5	Apparent	Nov-Jun	---	Moderate	Low-----	Moderate.
52----- Brevort	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	Moderate	High-----	Moderate.
53B, 53C, 53D----- Manistee	A	None-----	---	---	>6.0	---	---	---	Low-----	High-----	Moderate.
54B----- Allendale	B	None-----	---	---	1.0-2.0	Apparent	Nov-May	---	Moderate	High-----	Moderate.
57A----- Belding	B	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	High-----	High-----	Moderate.
63----- Evart	D	Frequent----	Brief to long.	Nov-Jun	0-2.0	Apparent	Jan-Dec	---	Moderate	High-----	Low.
64B, 64C----- Melita	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
65----- Arnheim	D	Frequent----	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	---	High-----	High-----	Moderate.
70----- Loxley	A/D	None-----	---	---	+1-1.0	Apparent	Nov-May	50-55	High-----	High-----	High.
71----- Dawson	A/D	None-----	---	---	+1-1.0	Apparent	Sep-Jun	30-36	High-----	High-----	High.
74----- Cathro	A/D	None-----	---	---	+1-1.0	Apparent	Nov-Jun	19-22	High-----	High-----	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months			Uncoated steel	Concrete
					In						
76----- Lupton	A/D	None-----	---	---	+1-1.0	Apparent	Sep-May	50-55	High----	High----	Low.
77----- Tawas	A/D	None-----	---	---	+1-1.0	Apparent	Nov-May	25-30	High----	High----	Moderate.
78----- Rondeau	A/D	None-----	---	---	+1-1.0	Apparent	Jan-Dec	35	High----	High----	Low.
79----- Grousehaven	D	None-----	---	---	+1-1.0	Apparent	Jan-Dec	---	High----	High----	Low.
82B*, 82C*, 82D*, 82E*: Nester-----	C	None-----	---	---	>6.0	---	---	---	Moderate	High----	Low.
Manistee-----	A	None-----	---	---	>6.0	---	---	---	Low-----	High----	Moderate.
83B*, 83C*, 83E*: Rubicon-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	High.
Menominee-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
85B*: Kent-----	D	None-----	---	---	2.0-3.0	Perched	Nov-Apr	---	Moderate	High----	Low.
Selkirk-----	C	None-----	---	---	0.5-1.5	Apparent	Nov-May	---	High----	High----	Low.
86C*, 86D*, 86E*: Nester-----	C	None-----	---	---	>6.0	---	---	---	Moderate	High----	Low.
Graycalm-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
87C*, 87E*: Isabella-----	B	None-----	---	---	>6.0	---	---	---	Moderate	High----	Moderate.
Melita-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
90C*: Rubicon-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	High.
Montcalm-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
93C*, 93D*, 93E*: Klacking-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
Isabella-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Total		Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
94B*, 94C*, 94E*: Isabella-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.
Montcalm-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.
97B*, 97C*: Isabella-----	B	None-----	---	---	>6.0	---	---	---	Moderate	Low-----	Moderate.
Melita-----	A	None-----	---	---	>6.0	---	---	---	Low-----	Low-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

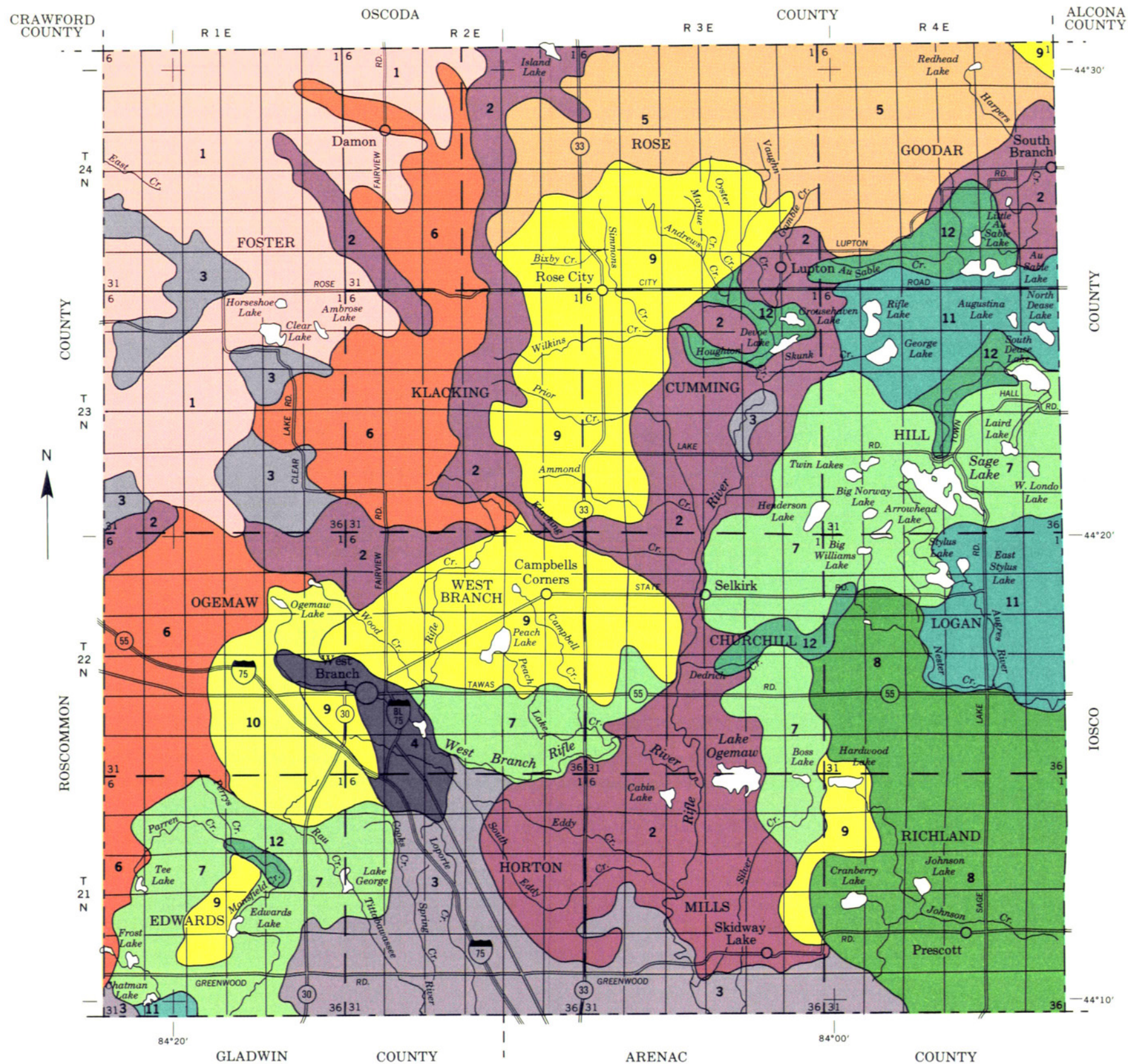
(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
*Alcona-----	Coarse-loamy, mixed, frigid Alfic Haplorthods
Allendale-----	Sandy over clayey, mixed, frigid Alfic Haplaquods
Angelica-----	Fine-loamy, mixed, nonacid, frigid Aeric Haplaquepts
Aquents-----	Mixed, nonacid, frigid Aquents
*Arnheim-----	Coarse-loamy, mixed, nonacid, frigid Typic Fluvaquents
Au Gres-----	Sandy, mixed, frigid Entic Haplaquods
*Belding-----	Coarse-loamy, mixed, frigid Alfic Haplaquods
*Brevort-----	Sandy over loamy, mixed, nonacid, frigid Mollic Haplaquents
Cathro-----	Loamy, mixed, euic Terric Borosaprists
Colonville-----	Coarse-loamy, mixed (calcareous), frigid Fluvaquentic Haplaquolls
Crowell-----	Sandy, mixed, frigid Entic Haplorthods
Dawson-----	Sandy or sandy-skeletal, mixed, dysic Terric Borosaprists
*East Lake-----	Sandy, mixed, frigid Entic Haplorthods
Epoufette-----	Coarse-loamy, mixed, frigid Mollic Ochraqualfs
Evart-----	Sandy, mixed, frigid Fluvaquentic Haplaquolls
Gladwin-----	Sandy, mixed, frigid Alfic Haplaquods
Graycalm-----	Mixed, frigid Alfic Udipsamments
Grayling-----	Mixed, frigid Typic Udipsamments
Grousehaven-----	Fine-silty, carbonatic, frigid Histic Humaquepts
Histosols-----	Euic, frigid Histosols
Ingalls-----	Sandy over loamy, mixed, frigid Entic Haplaquods
Iosco-----	Sandy over loamy, mixed, frigid Alfic Haplaquods
Isabella-----	Fine-loamy, mixed, frigid Alfic Haplorthods
Kawkawlin-----	Fine, mixed Aquic Eutroboralfs
Kent-----	Fine, illitic Typic Eutroboralfs
Klackung-----	Coarse-loamy, mixed Psammentic Eutroboralfs
Loxley-----	Dysic Typic Borosaprists
Lupton-----	Euic Typic Borosaprists
Mancelona-----	Sandy, mixed, frigid Alfic Haplorthods
Manistee-----	Sandy over clayey, mixed, frigid Alfic Haplorthods
Melita-----	Sandy, mixed, frigid Alfic Haplorthods
Menominee-----	Sandy over loamy, mixed, frigid Alfic Haplorthods
Montcalm-----	Coarse-loamy, mixed Eutric Glossoboralfs
Nester-----	Fine, mixed Typic Eutroboralfs
Pickford-----	Fine, mixed, nonacid, frigid Typic Haplaquepts
Rondeau-----	Marly, euic Limnic Borosaprists
Roscommon-----	Mixed, frigid Mollic Psammaquents
Rubicon-----	Sandy, mixed, frigid Entic Haplorthods
Selkirk-----	Fine, illitic Aquic Eutroboralfs
Sims-----	Fine, mixed, nonacid, frigid Mollic Haplaquepts
Tawas-----	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
Tonkey-----	Coarse-loamy, mixed, nonacid, frigid Mollic Haplaquepts
Udipsamments-----	Mixed, frigid Udipsamments
Udorthents-----	Loamy, mixed, frigid Udorthents
Wheatley-----	Mixed, frigid Mollic Psammaquents

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Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

- NEARLY LEVEL TO STEEP, SOMEWHAT EXCESSIVELY DRAINED AND EXCESSIVELY DRAINED SOILS
- 1 Graycalm-Grayling Association: Nearly level to steep, somewhat excessively drained and excessively drained, sandy soils on outwash plains
- NEARLY LEVEL TO VERY STEEP, EXCESSIVELY DRAINED, SOMEWHAT EXCESSIVELY DRAINED, SOMEWHAT POORLY DRAINED, AND POORLY DRAINED SOILS
- 2 Graycalm-Rubicon-Mancelona Association: Nearly level to very steep, somewhat excessively drained and excessively drained, sandy soils on moraines and outwash plains
- 3 Rubicon-Au Gres-Roscommon Association: Nearly level to rolling, excessively drained, somewhat poorly drained, and poorly drained, sandy soils on outwash plains
- 4 Au Gres-Wheatley-Gladwin Association: Nearly level, somewhat poorly drained and poorly drained, sandy soils on outwash plains
- NEARLY LEVEL TO STEEP, SOMEWHAT EXCESSIVELY DRAINED AND WELL DRAINED SOILS
- 5 Montcalm-Isabella Association: Nearly level to steep, well drained, sandy soils on till plains and moraines
- 6 Graycalm-Montcalm-Klackang Association: Nearly level to steep, somewhat excessively drained and well drained, sandy soils on moraines and outwash plains
- NEARLY LEVEL TO STEEP, SOMEWHAT EXCESSIVELY DRAINED TO SOMEWHAT POORLY DRAINED SOILS
- 7 Nester-Menominee-Kawkawlin Association: Nearly level to rolling, well drained and somewhat poorly drained, sandy and loamy soils on moraines and till plains
- 8 Selkirk-Kent Association: Nearly level to rolling, somewhat poorly drained to well drained, loamy soils on moraines and till plains
- 9 Nester-Kawkawlin Association: Nearly level to steep, well drained and somewhat poorly drained, loamy soils on moraines and till plains
- 10 Mancelona-Nester-Manistee Association: Nearly level to steep, somewhat excessively drained and well drained, sandy and loamy soils on moraines
- NEARLY LEVEL AND UNDULATING, SOMEWHAT POORLY DRAINED AND POORLY DRAINED SOILS
- 11 Kawkawlin-Sims-Iosco Association: Nearly level and undulating, somewhat poorly drained and poorly drained, loamy and sandy soils on ground moraines
- NEARLY LEVEL, VERY POORLY DRAINED AND POORLY DRAINED SOILS
- 12 Lupton-Roscommon Association: Nearly level, very poorly drained and poorly drained, mucky and sandy soils on outwash plains

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the association.

Compiled 1989

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN TECHNOLOGICAL UNIVERSITY

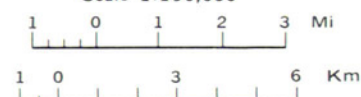
GENERAL SOIL MAP

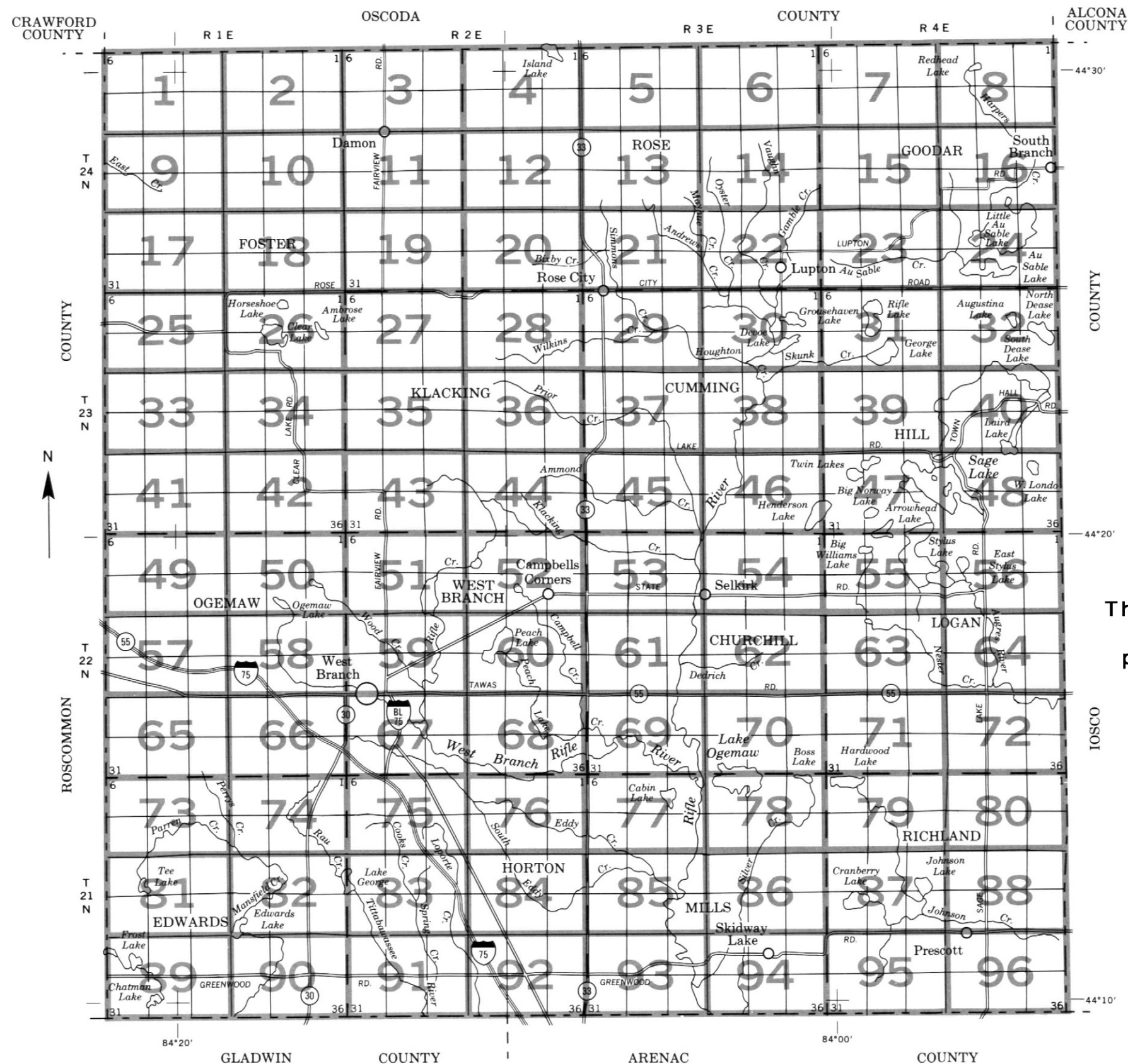
OGE MAW COUNTY, MICHIGAN

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 1:190,080



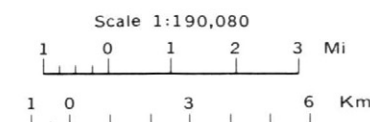


Original text from each individual map sheet read:
 This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981-1983 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED
TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS OGEMAW COUNTY, MICHIGAN



SOIL LEGEND

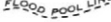
Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded and 3 that it is severely eroded.

SYMBOL	NAME	SYMBOL	NAME
10B	Grayling sand, 0 to 6 percent slopes	45	Wheatley mucky loamy sand
10C	Grayling sand, 6 to 18 percent slopes	46B	Mancelona sand, 0 to 6 percent slopes
10E	Grayling sand, 18 to 35 percent slopes	46C	Mancelona sand, 6 to 18 percent slopes
11B	Rubicon sand, 0 to 6 percent slopes	46E	Mancelona sand, 18 to 35 percent slopes
11C	Rubicon sand, 6 to 18 percent slopes	46F	Mancelona sand, 35 to 50 percent slopes
11E	Rubicon sand, 18 to 35 percent slopes	47A	Gladwin sand, 0 to 3 percent slopes
11F	Rubicon sand, 35 to 50 percent slopes	48	Epoufette mucky sand
12B	Croswell sand, 0 to 4 percent slopes	49A	Colonville silt loam, 0 to 3 percent slopes
13A	Au Gres sand, 0 to 3 percent slopes	50B	Menominee sand, 0 to 6 percent slopes
14	Roscommon mucky sand	50C	Menominee sand, 6 to 12 percent slopes
17B	Graycalm sand, 0 to 6 percent slopes	50D	Menominee sand, 12 to 18 percent slopes
17C	Graycalm sand, 6 to 18 percent slopes	50E	Menominee sand, 18 to 35 percent slopes
17E	Graycalm sand, 18 to 35 percent slopes	51B	Iosco sand, 0 to 4 percent slopes
18B	Klacking sand, 0 to 6 percent slopes	52	Brevort mucky loamy sand
18C	Klacking sand, 6 to 18 percent slopes	53B	Manistee loamy sand, 0 to 6 percent slopes
18E	Klacking sand, 18 to 35 percent slopes	53C	Manistee loamy sand, 6 to 12 percent slopes
20B	Montcalm loamy sand, 0 to 6 percent slopes	53D	Manistee loamy sand, 12 to 18 percent slopes
20C	Montcalm loamy sand, 6 to 18 percent slopes	54B	Allendale loamy sand, 0 to 4 percent slopes
20E	Montcalm loamy sand, 18 to 35 percent slopes	57A	Belding sandy loam, 0 to 3 percent slopes
21	Histosols and Aquents, ponded	63	Ewart sand
22B	Nester fine sandy loam, 2 to 6 percent slopes	64B	Melita sand, 0 to 6 percent slopes
22B2	Nester loam, 2 to 6 percent slopes, eroded	64C	Melita sand, 6 to 18 percent slopes
22C	Nester fine sandy loam, 6 to 12 percent slopes	65	Arnhem silt loam
22C2	Nester loam, 6 to 12 percent slopes, eroded	70	Loxley peat
22D	Nester fine sandy loam, 12 to 18 percent slopes	71	Dawson peat
22D2	Nester loam, 12 to 18 percent slopes, eroded	74	Cathro muck
22D3	Nester clay loam, 12 to 25 percent slopes, severely eroded	76	Lupton muck
22E	Nester fine sandy loam, 18 to 35 percent slopes	77	Tawas mucky peat
22F	Nester fine sandy loam, 35 to 50 percent slopes	78	Rondeau muck
23B	Kawkawlin loam, 0 to 4 percent slopes	79	Grousehaven muck
24	Sims loam	82B	Nester-Manistee complex, 2 to 6 percent slopes
25B	Kent sandy loam, 2 to 6 percent slopes	82C	Nester-Manistee complex, 6 to 12 percent slopes
25B2	Kent loam, 2 to 6 percent slopes, eroded	82D	Nester-Manistee complex, 12 to 18 percent slopes
25C	Kent sandy loam, 6 to 12 percent slopes	82E	Nester-Manistee complex, 18 to 35 percent slopes
25C2	Kent loam, 6 to 12 percent slopes, eroded	83B	Rubicon-Menominee sands, 0 to 6 percent slopes
25D	Kent sandy loam, 12 to 18 percent slopes	83C	Rubicon-Menominee sands, 6 to 18 percent slopes
26B	Selkirk loam, 0 to 4 percent slopes	83E	Rubicon-Menominee sands, 18 to 35 percent slopes
27	Pickford silty clay loam	85B	Kent-Selkirk complex, 0 to 6 percent slopes
28	Udorthents, loamy, nearly level	86C	Nester-Graycalm complex, 6 to 12 percent slopes
29	Udipsammments, nearly level	86D	Nester-Graycalm complex, 12 to 18 percent slopes
30B	Isabella loamy sand, 2 to 6 percent slopes	86E	Nester-Graycalm complex, 18 to 35 percent slopes
30C	Isabella loamy sand, 6 to 12 percent slopes	87C	Isabella-Melita complex, burned, 6 to 18 percent slopes
30D	Isabella loamy sand, 12 to 18 percent slopes	87E	Isabella-Melita complex, burned, 18 to 40 percent slopes
30E	Isabella loamy sand, 18 to 35 percent slopes	90C	Rubicon-Montcalm complex, 6 to 18 percent slopes
32	Angelica loam	93C	Klacking-Isabella complex, 6 to 12 percent slopes
36B	Alcona loamy fine sand, 2 to 6 percent slopes	93D	Klacking-Isabella complex, 12 to 18 percent slopes
37A	Ingalls sand, 0 to 3 percent slopes	93E	Klacking-Isabella complex, 18 to 25 percent slopes
38	Tonkey sandy loam	94B	Isabella-Montcalm loamy sands, 0 to 6 percent slopes
39	Pits, gravel	94C	Isabella-Montcalm loamy sands, 6 to 18 percent slopes
42C	Nester-Mancelona complex, 6 to 12 percent slopes	94E	Isabella-Montcalm loamy sands, 18 to 25 percent slopes
43B	East Lake sand, 0 to 6 percent slopes	97B	Isabella-Melita complex, 0 to 6 percent slopes
44B	Croswell sand, loamy substratum, 0 to 3 percent slopes	97C	Isabella-Melita complex, 6 to 18 percent slopes

CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

National, state or province	— — — —
County or parish	— — — —
Minor civil division	— — — —
Reservation (national forest or park, state forest or park, and large airport)	— . — —
Land grant	— . . . —
Limit of soil survey (label)	— — — —
Field sheet matchline and neatline	— — — —
AD HOC BOUNDARY (label)	
Small airport, airfield, park, oilfield, cemetery, or flood pool	
STATE COORDINATE TICK	— —
LAND DIVISION CORNER (sections and land grants)	— + — + — + —

ROADS

Divided (median shown if scale permits)	==
Other roads	— — — —
Trail	- - - - -

ROAD EMBLEM & DESIGNATIONS

Interstate	
Federal	
State	
County, farm or ranch	

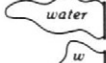
RAILROAD

POWER TRANSMISSION LINE (normally not shown)	— —
PIPE LINE (normally not shown)	— — — —
FENCE (normally not shown)	— x — x —

LEVEES

Without road	
With road	
With railroad	

DAMS

Large (to scale)	
Medium or Small	

PITS

Gravel pit	
Mine or quarry	

MISCELLANEOUS CULTURAL FEATURES

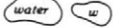
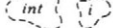
Farmstead, house (omit in urban areas)	•
Church	✠
School	✎
Indian mound (label)	
Located object (label)	
Tank (label)	• Gas
Wells, oil or gas	
Windmill	✠
Kitchen midden	—

WATER FEATURES

DRAINAGE

Perennial, double line	
Perennial, single line	
Intermittent	
Drainage end	
Canals or ditches	
Double-line (label)	
Drainage and/or irrigation	

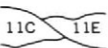
LAKES, PONDS AND RESERVOIRS

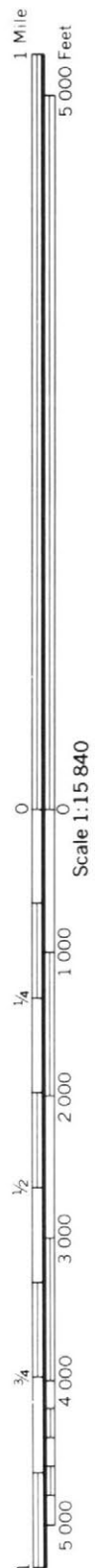
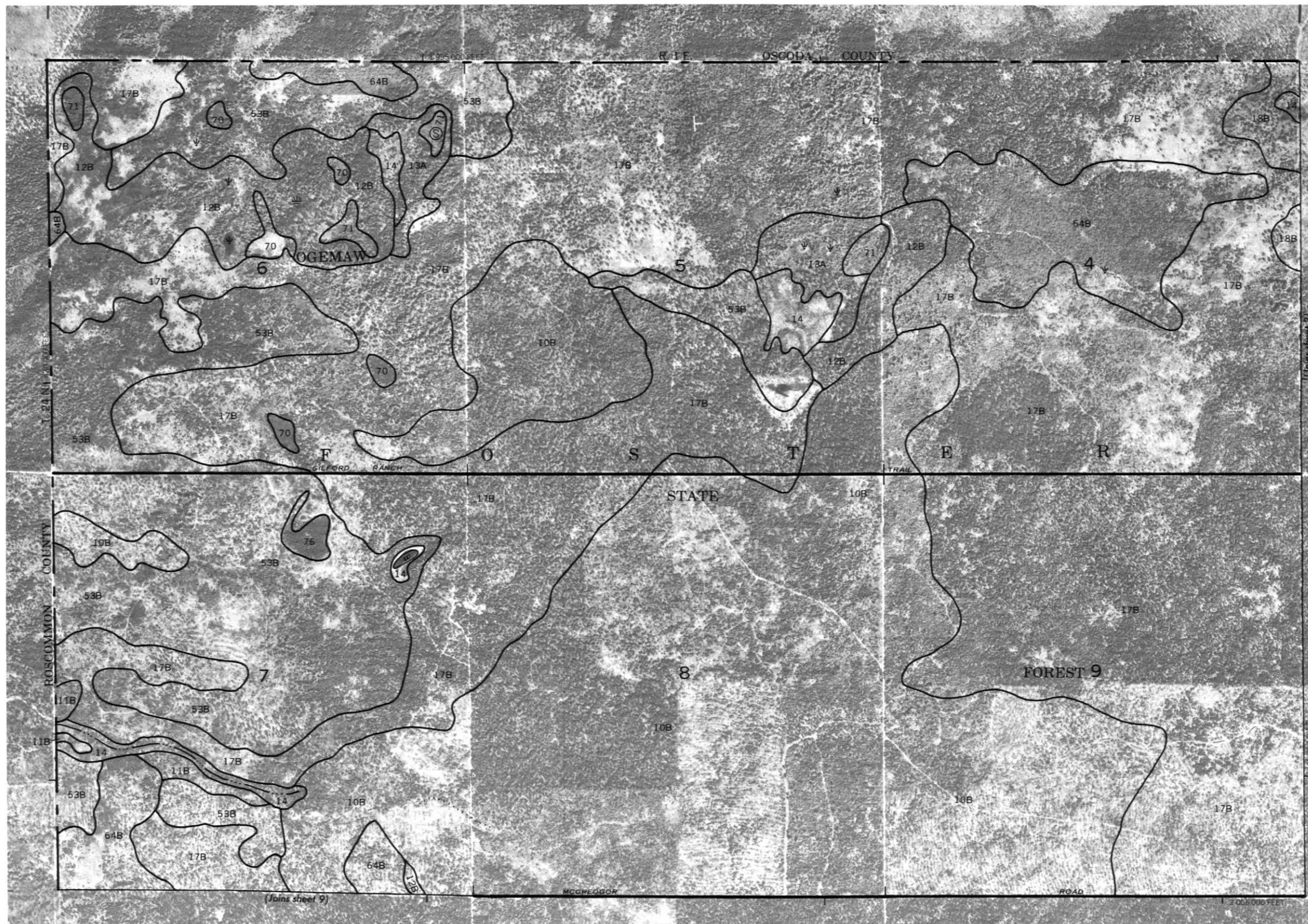
Perennial	
Intermittent	

MISCELLANEOUS WATER FEATURES

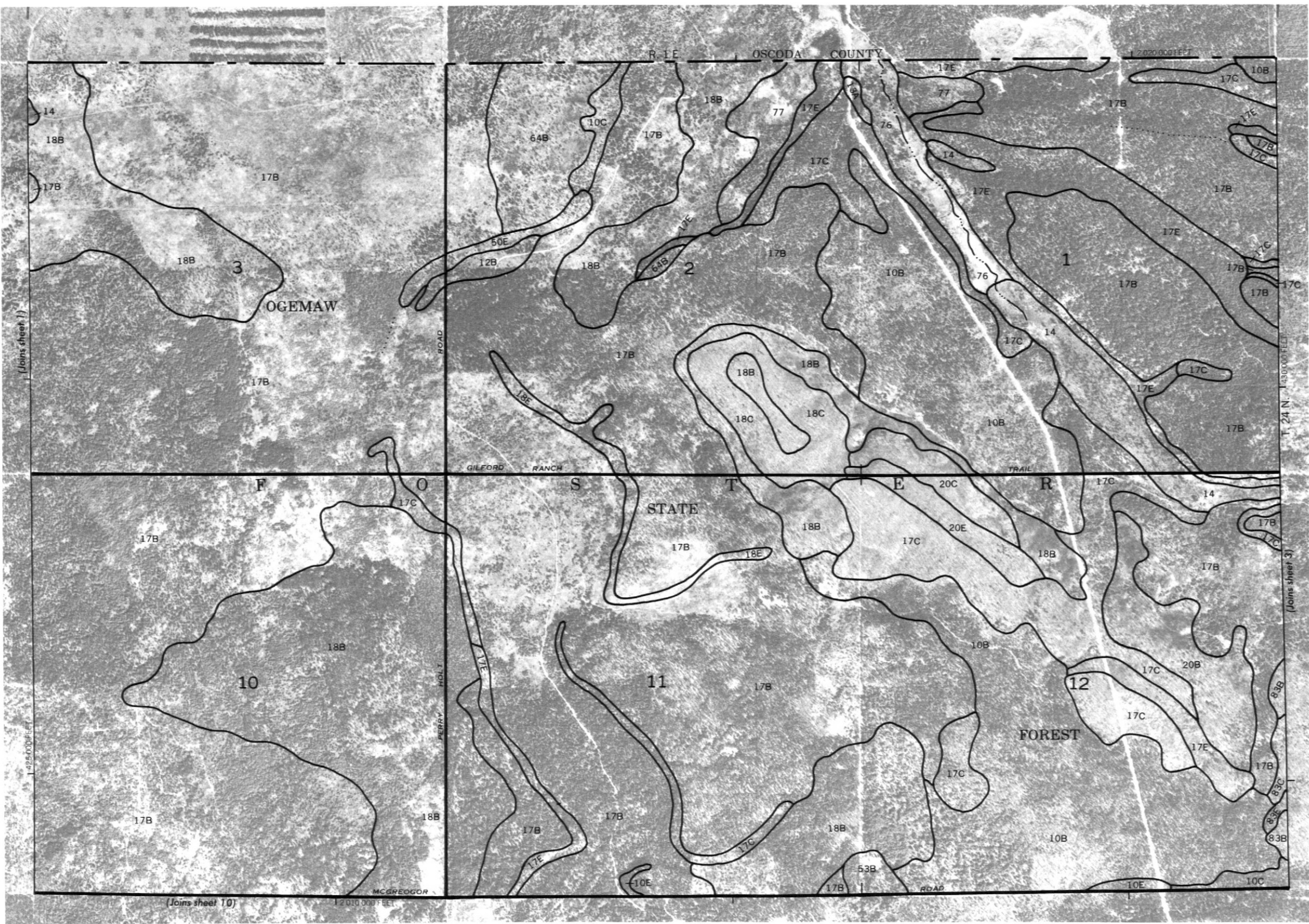
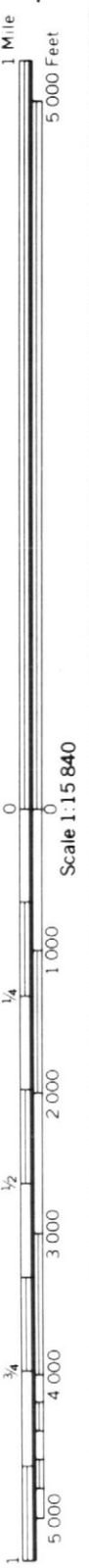
Marsh or swamp	
Spring	
Well, artesian	
Well, irrigation	
Wet spot	

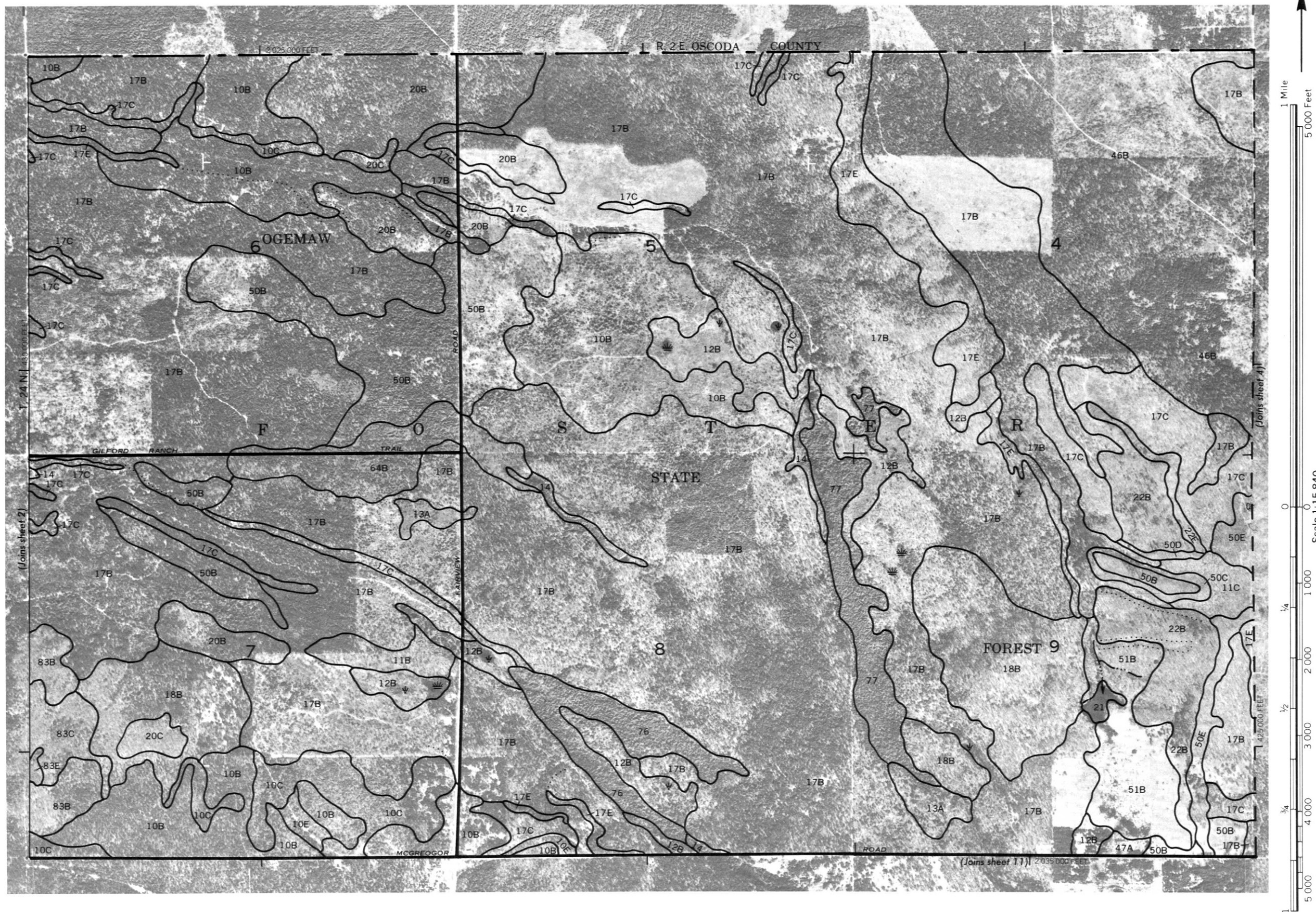
SPECIAL SYMBOLS FOR
SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS	
ESCARPMENTS	
Bedrock (points down slope)	*****
Other than bedrock (points down slope)	*****
SHORT STEEP SLOPE	
GULLY	~~~~~
DEPRESSION OR SINK	◊
SOIL SAMPLE (normally not shown)	⊙
MISCELLANEOUS	
Blowout	∪
Clay spot	✱
Gravelly spot	⊙
Gumbo, slick or scabby spot (sodic)	⊙
Dumps and other similar non soil areas	≡
Prominent hill or peak	⊙
Rock outcrop (includes sandstone and shale)	∇
Saline spot	+
Sandy spot	⊙
Severely eroded spot	≡
Slide or slip (tips point upslope)	⊙
Stony spot, very stony spot	⊙
Loamy spot < 5 acres	⊙
Mineral in Organic < 5 acres	⊙
Organic spot < 5 acres	⊙



2





4

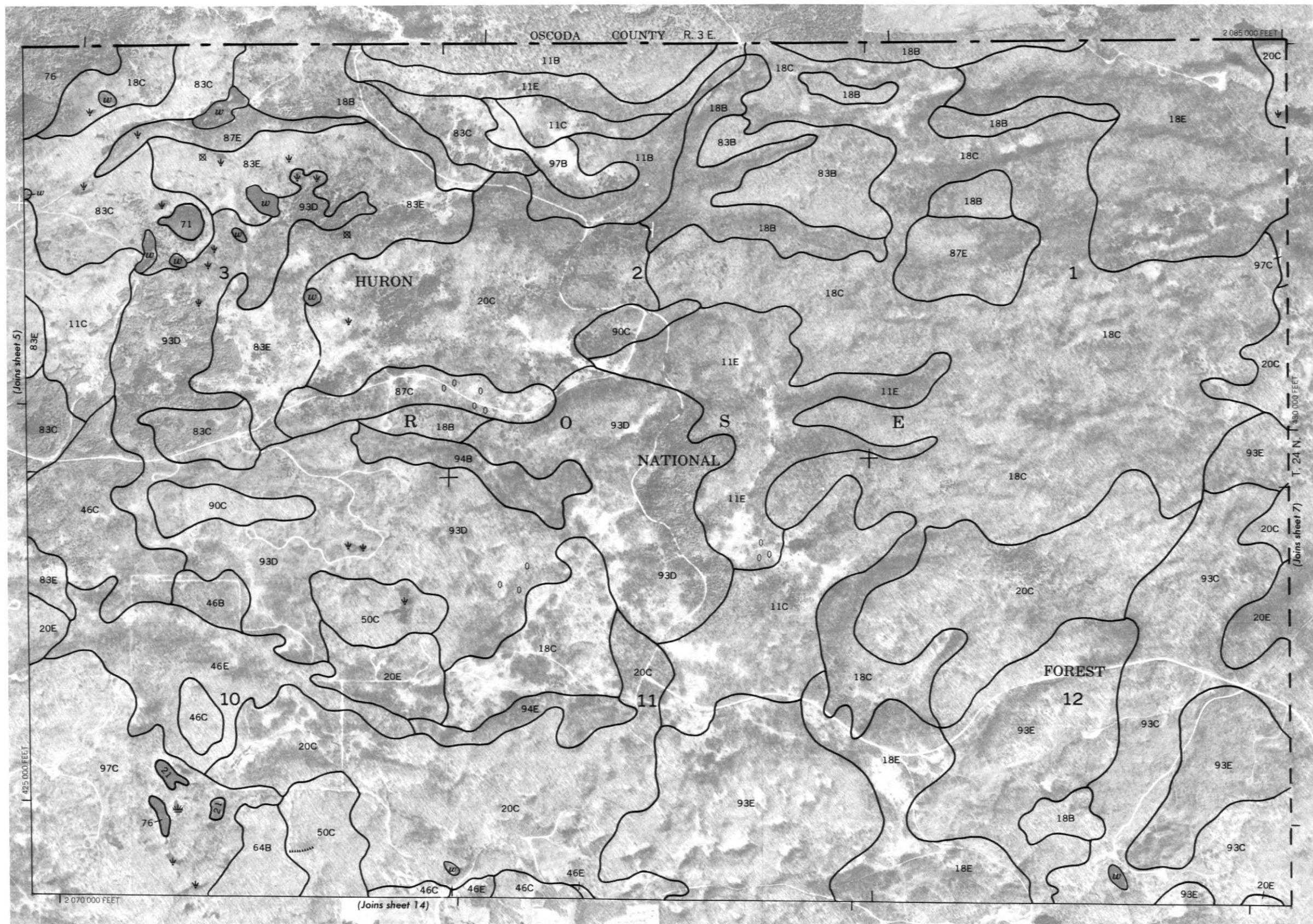


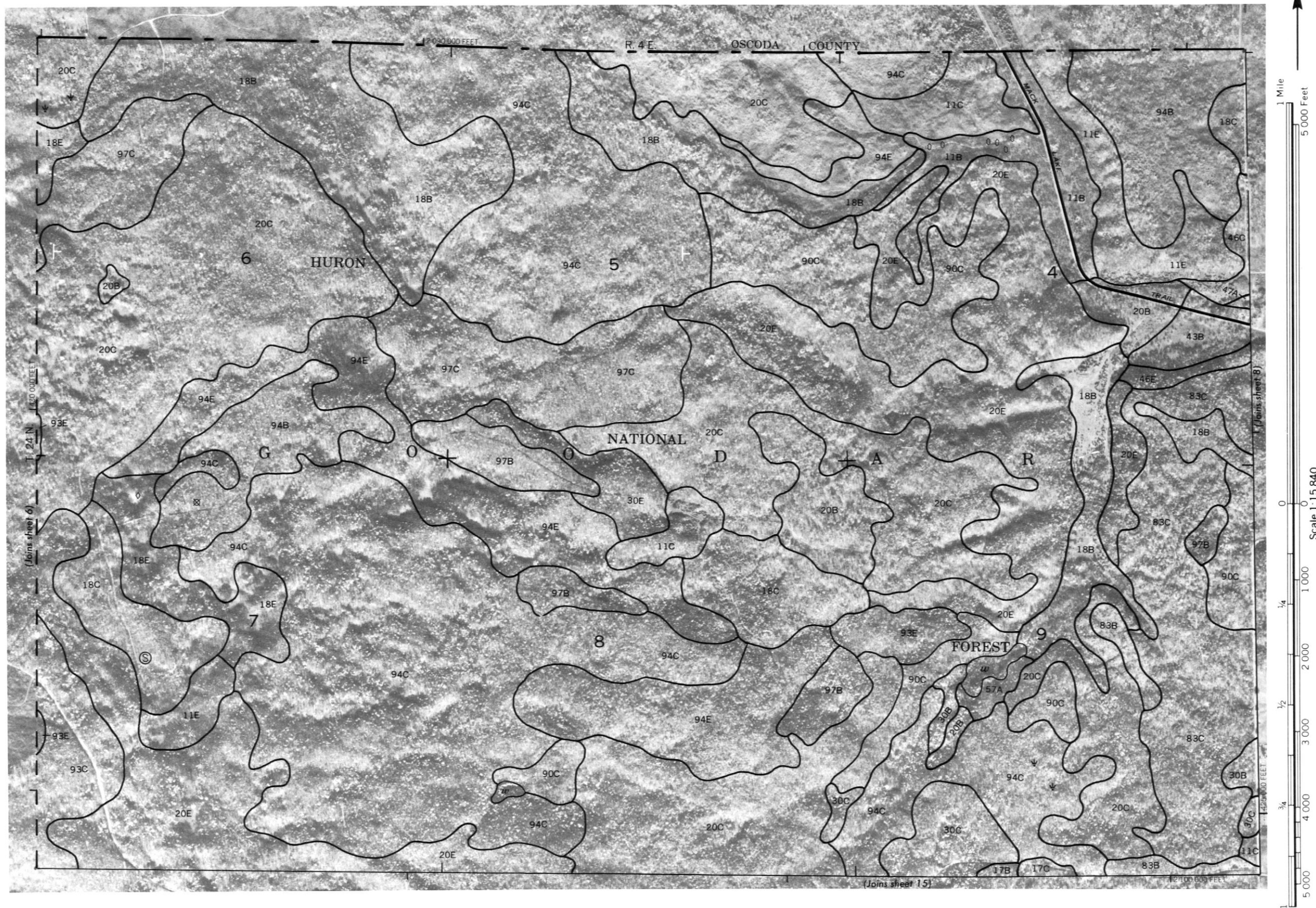
(Joins sheet 3)

(Joins sheet 5)

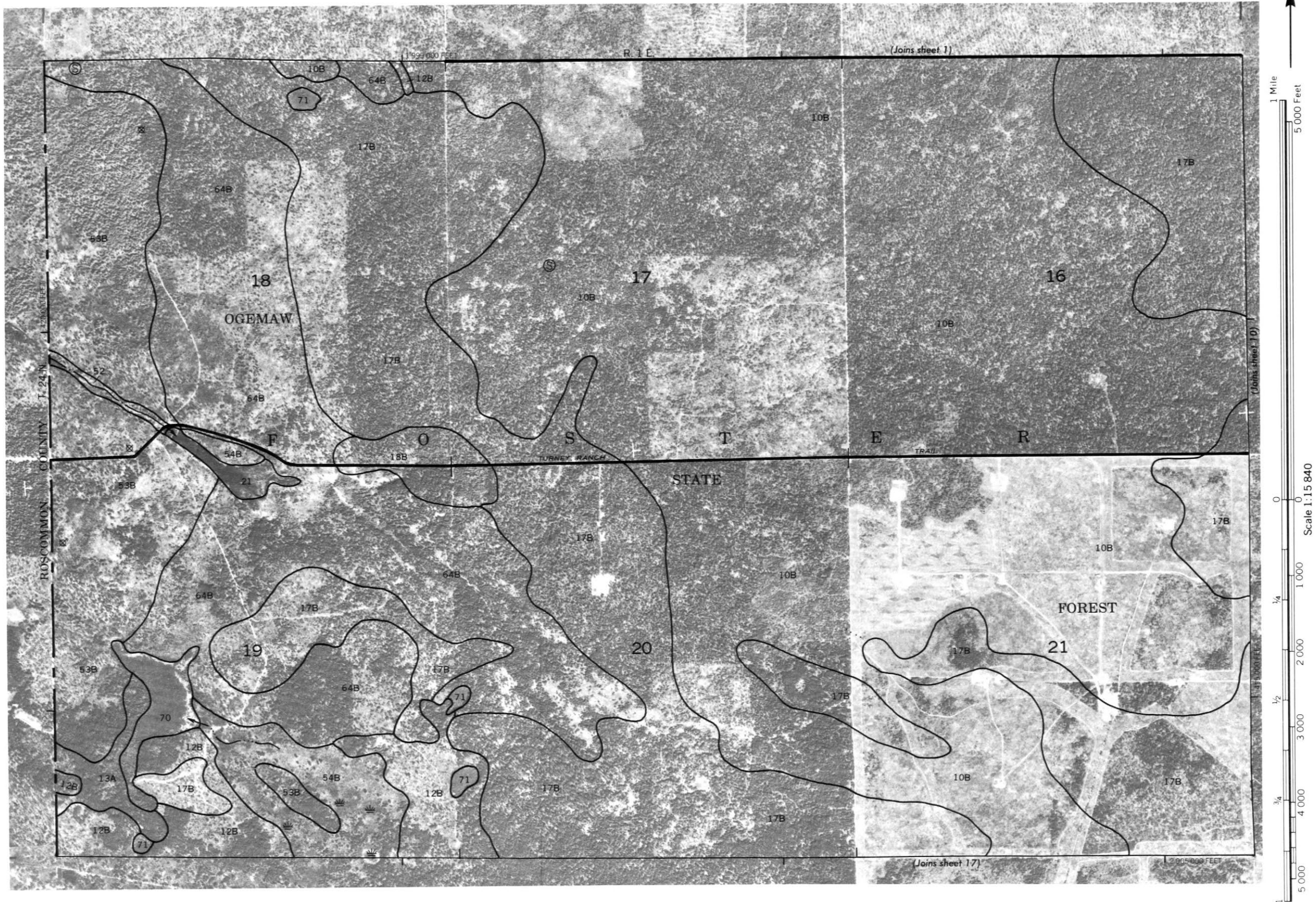
(Joins sheet 12)









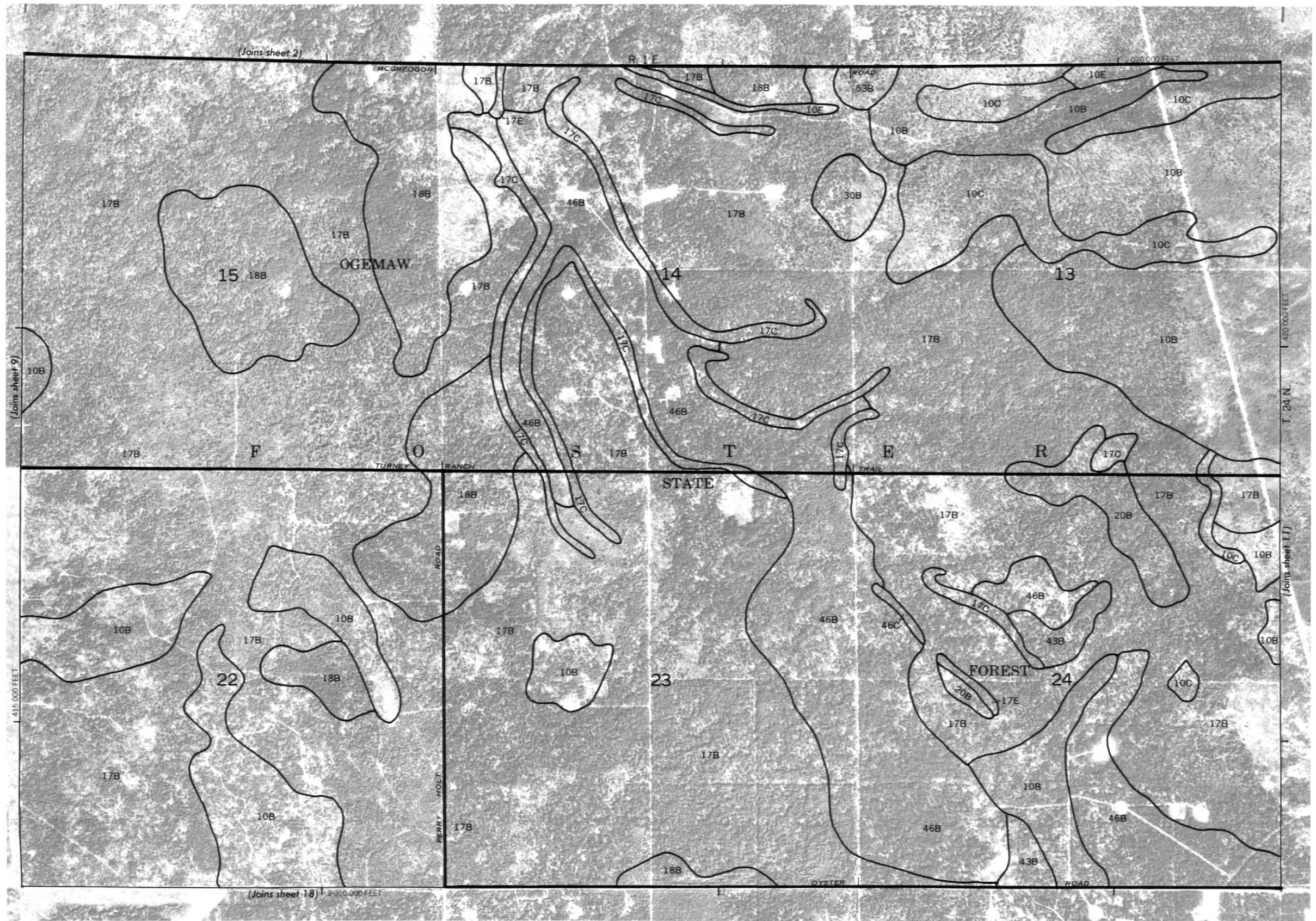


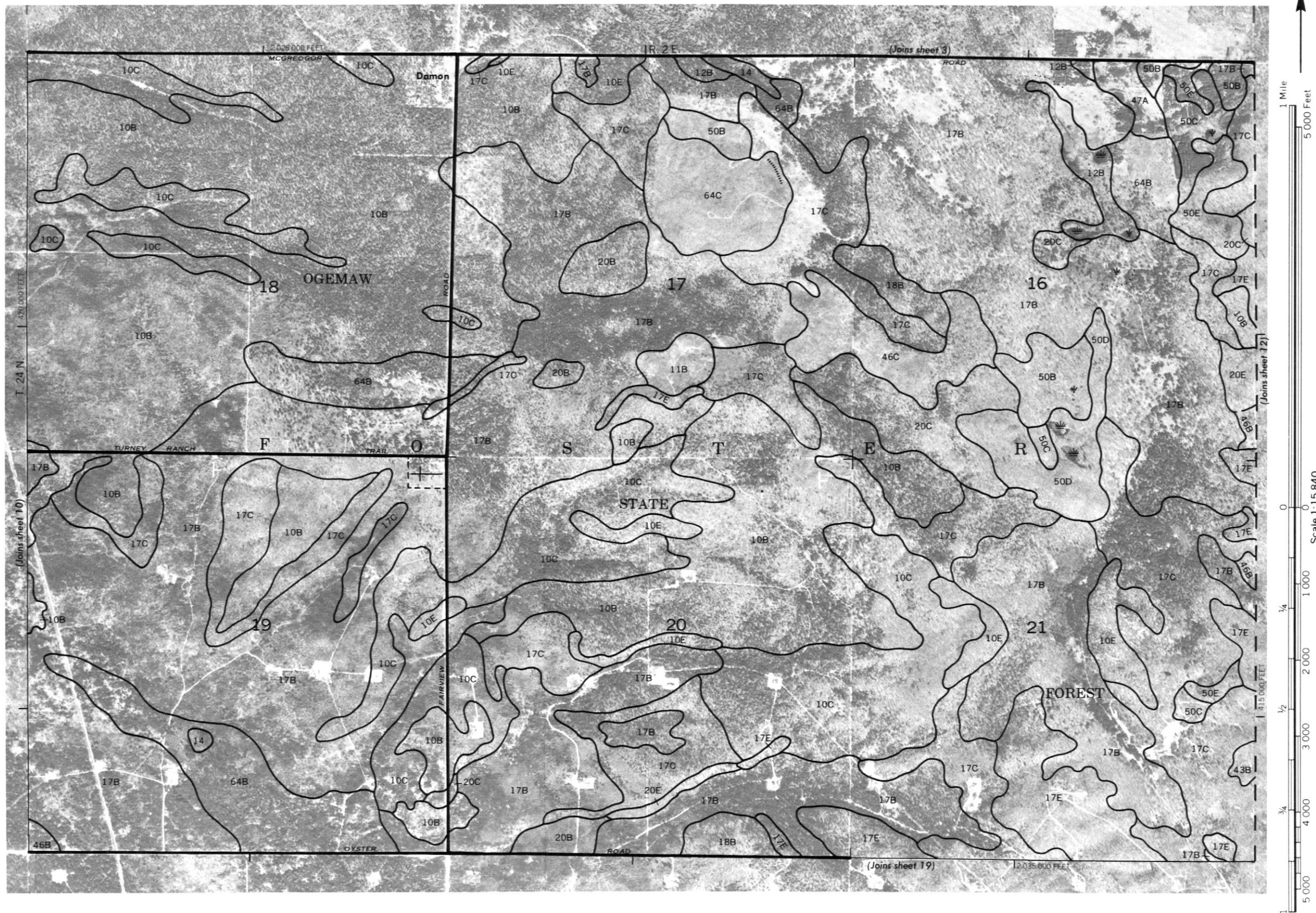


1 Mile
5 000 Feet

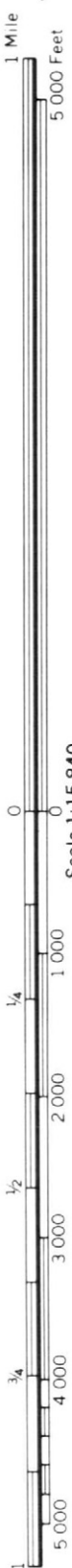
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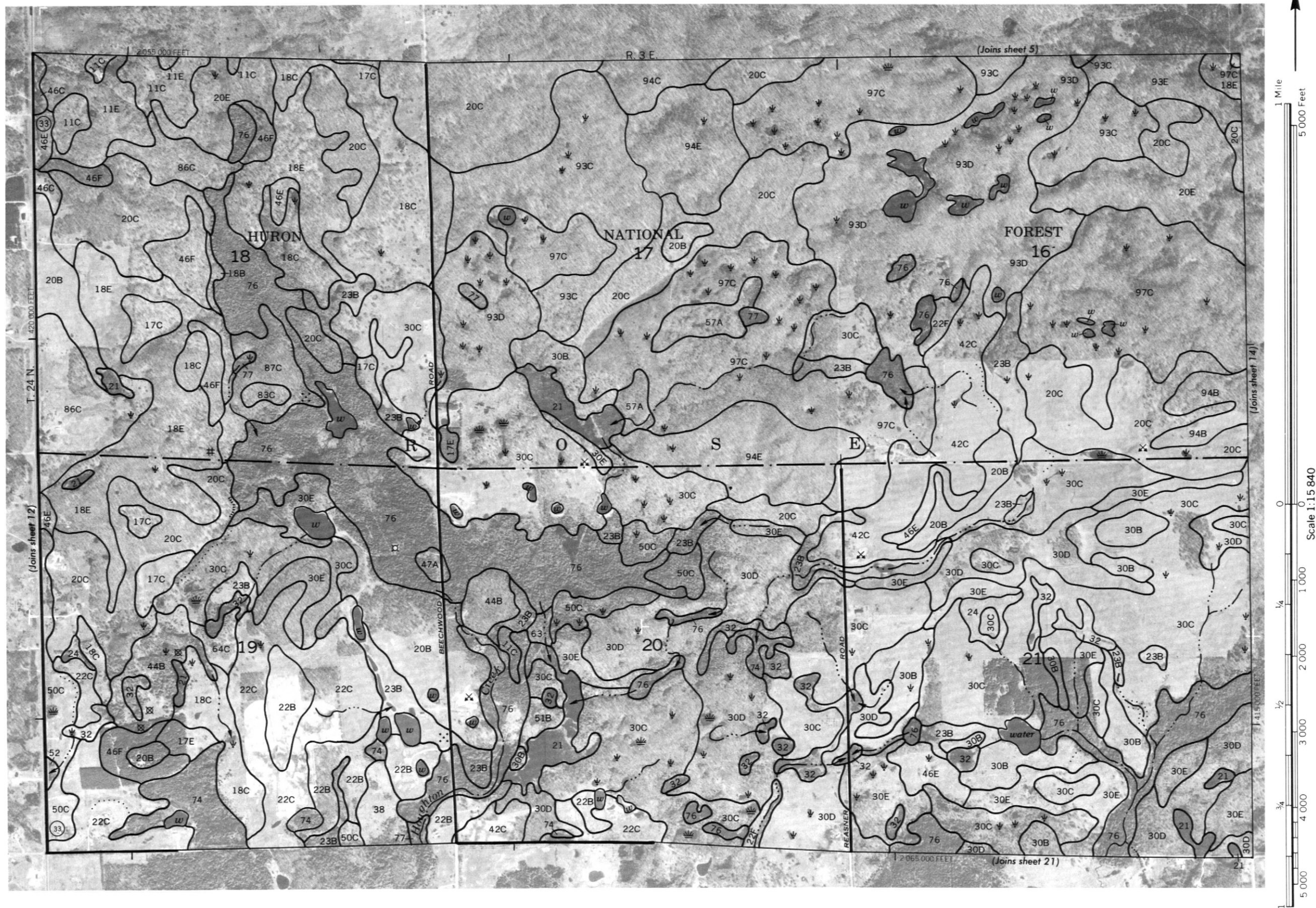
1/4 1 000
1/2 2 000
3/4 3 000
4 000
5 000

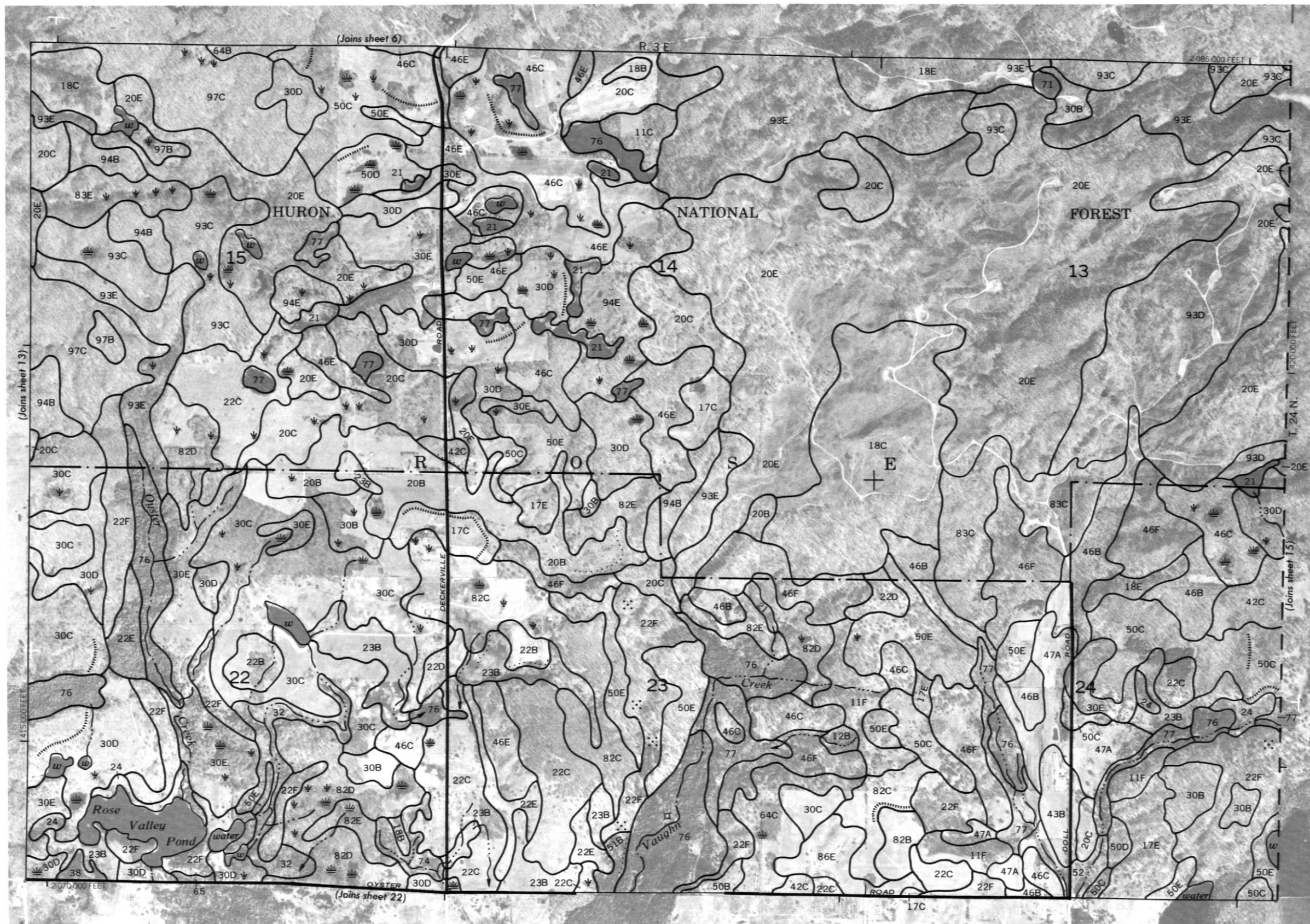


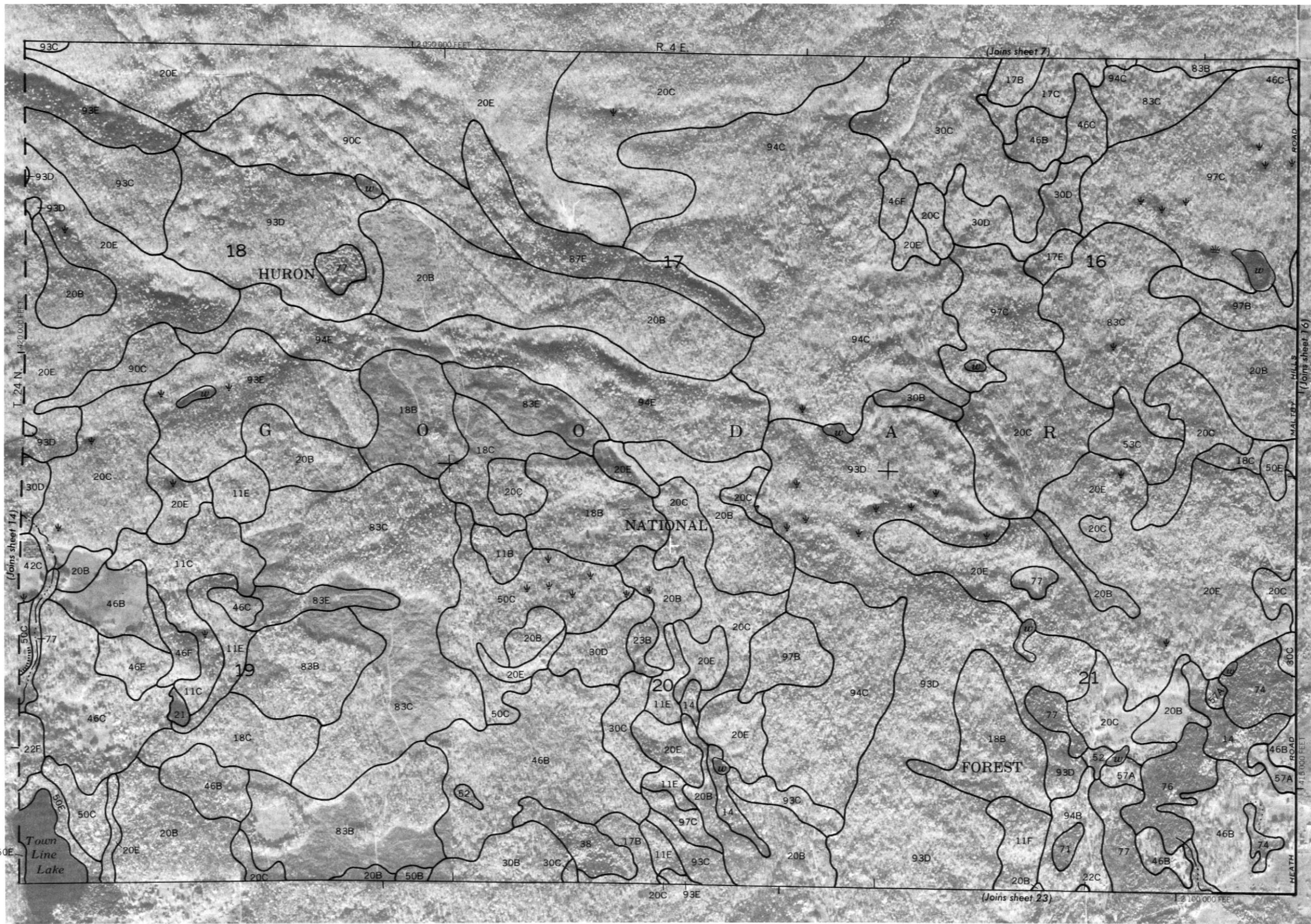


12









16

N

1 Mile
5 000 Feet

Scale 1:15 840

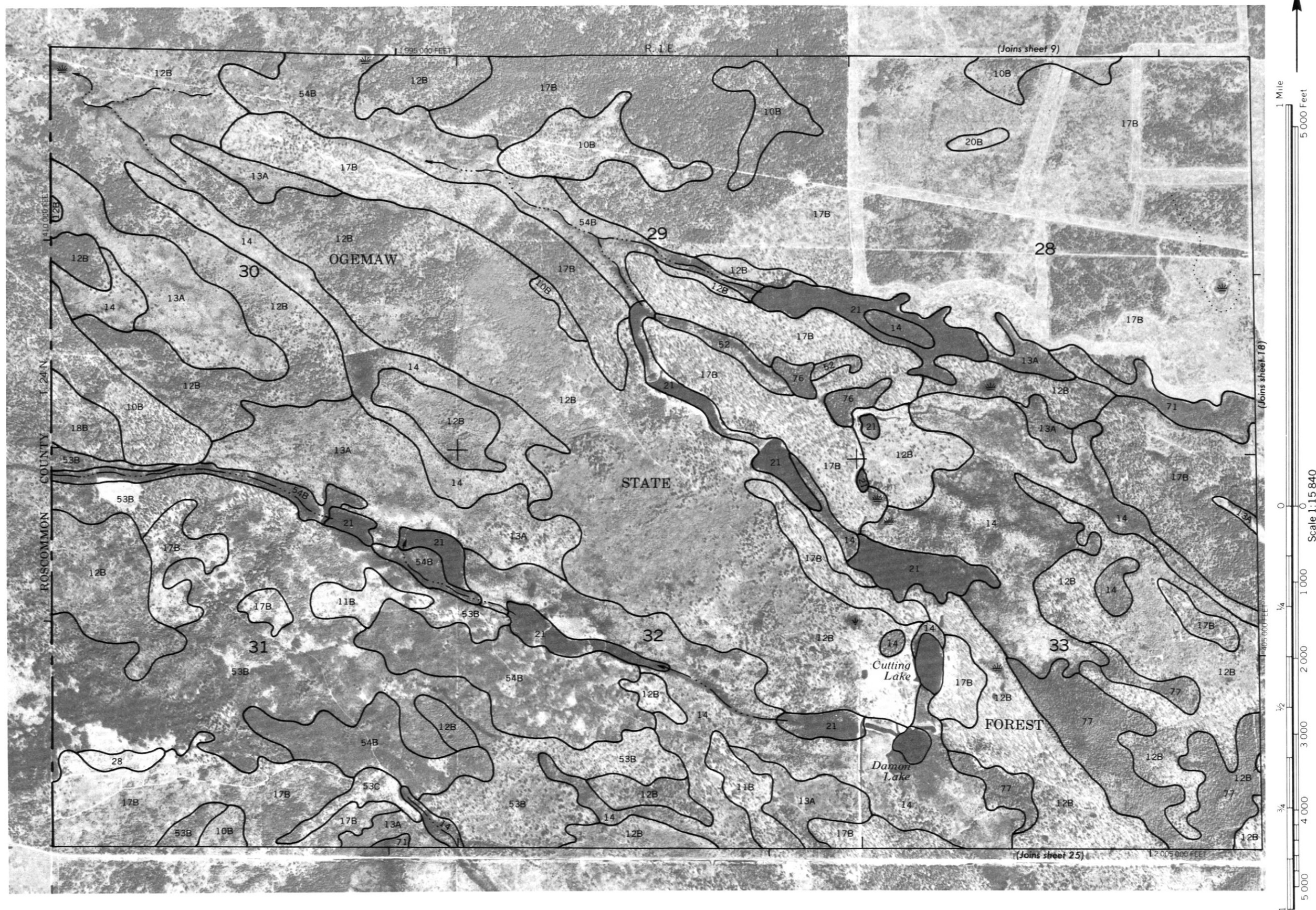
1/4 1 000

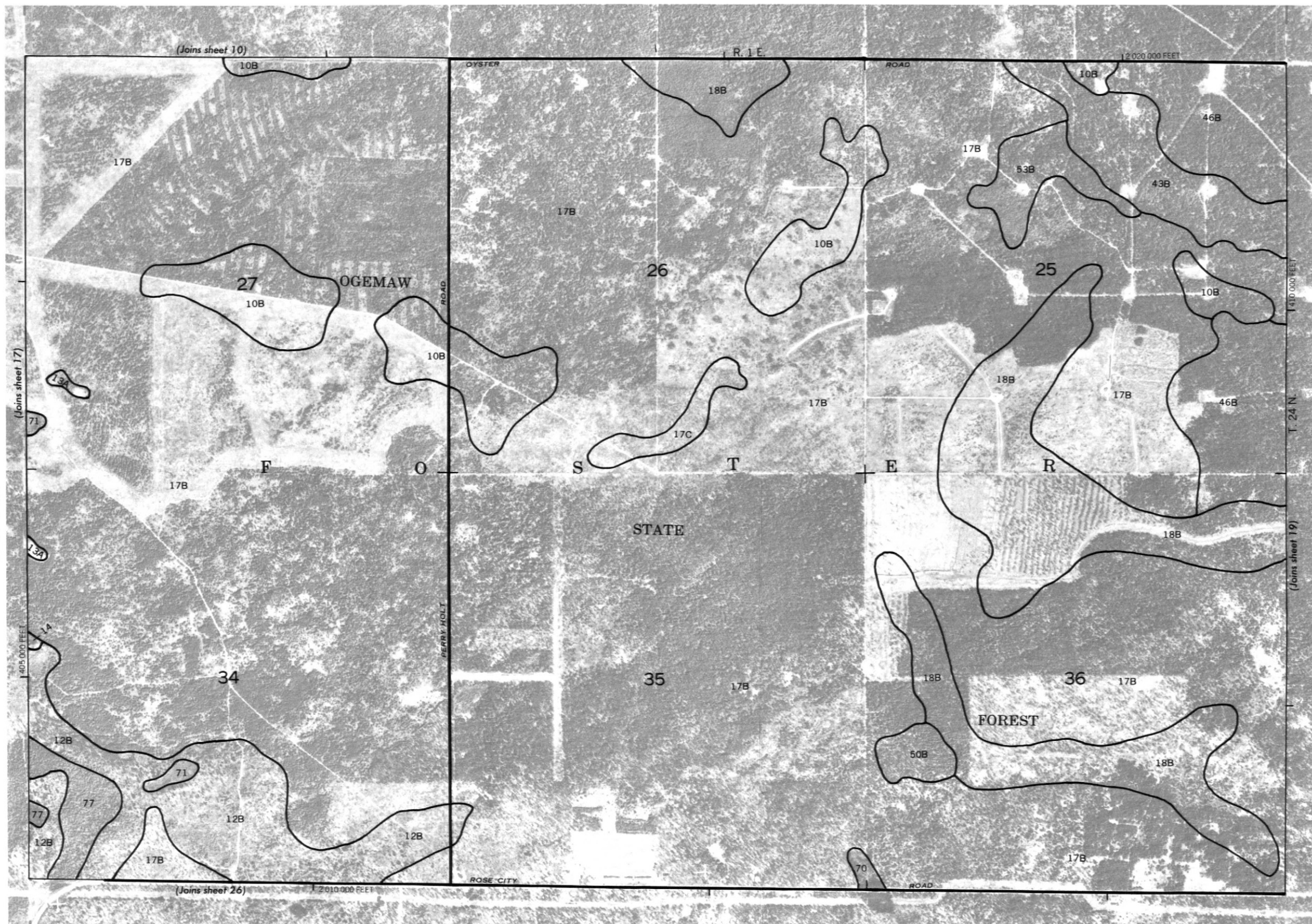
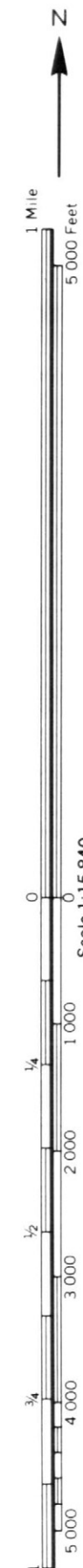
1/2 2 000

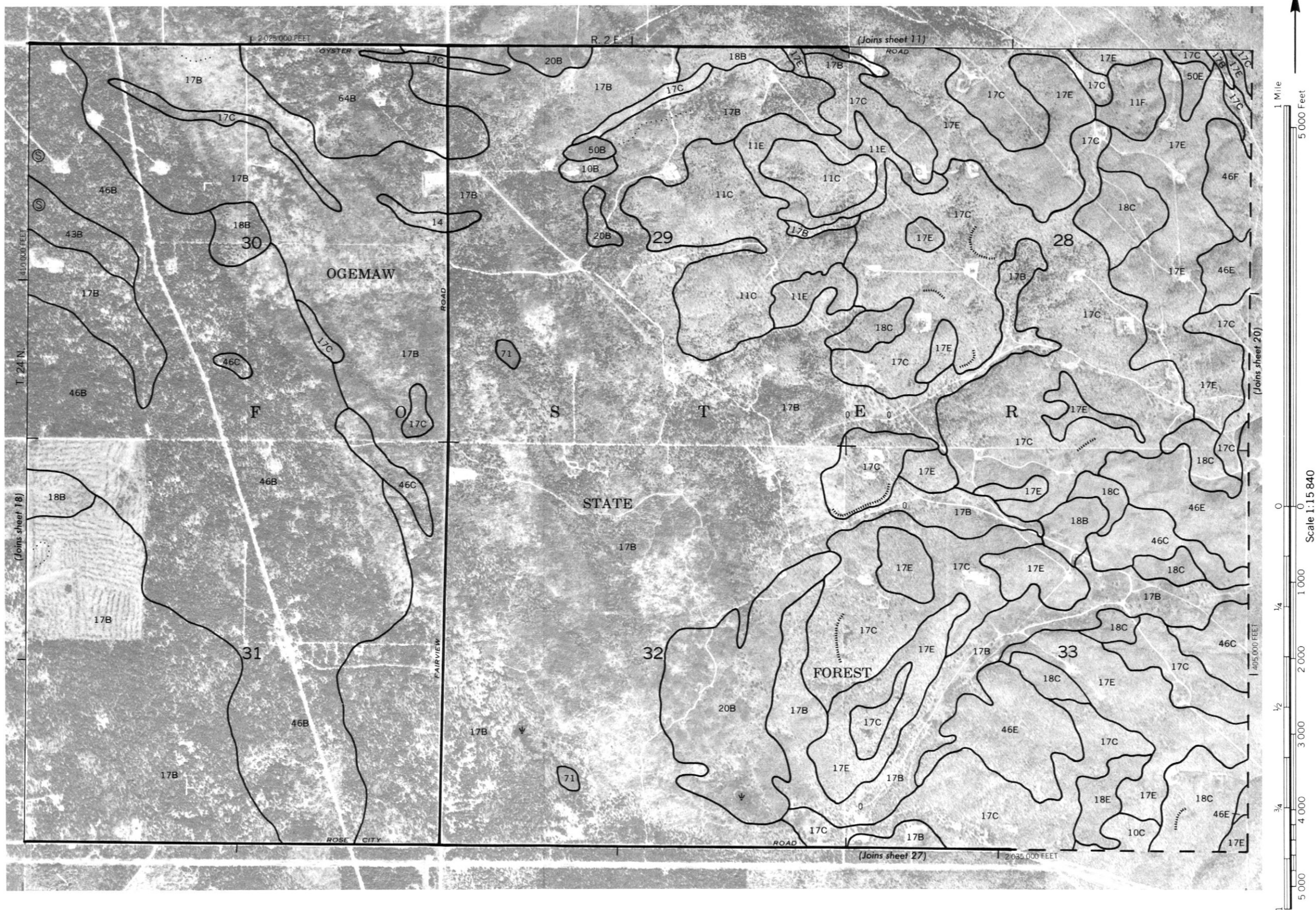
3/4 3 000

5 000









20



1 Mile
5 000 Feet

Scale 1:15 840

1/4

1 405 000 FEET

1 000

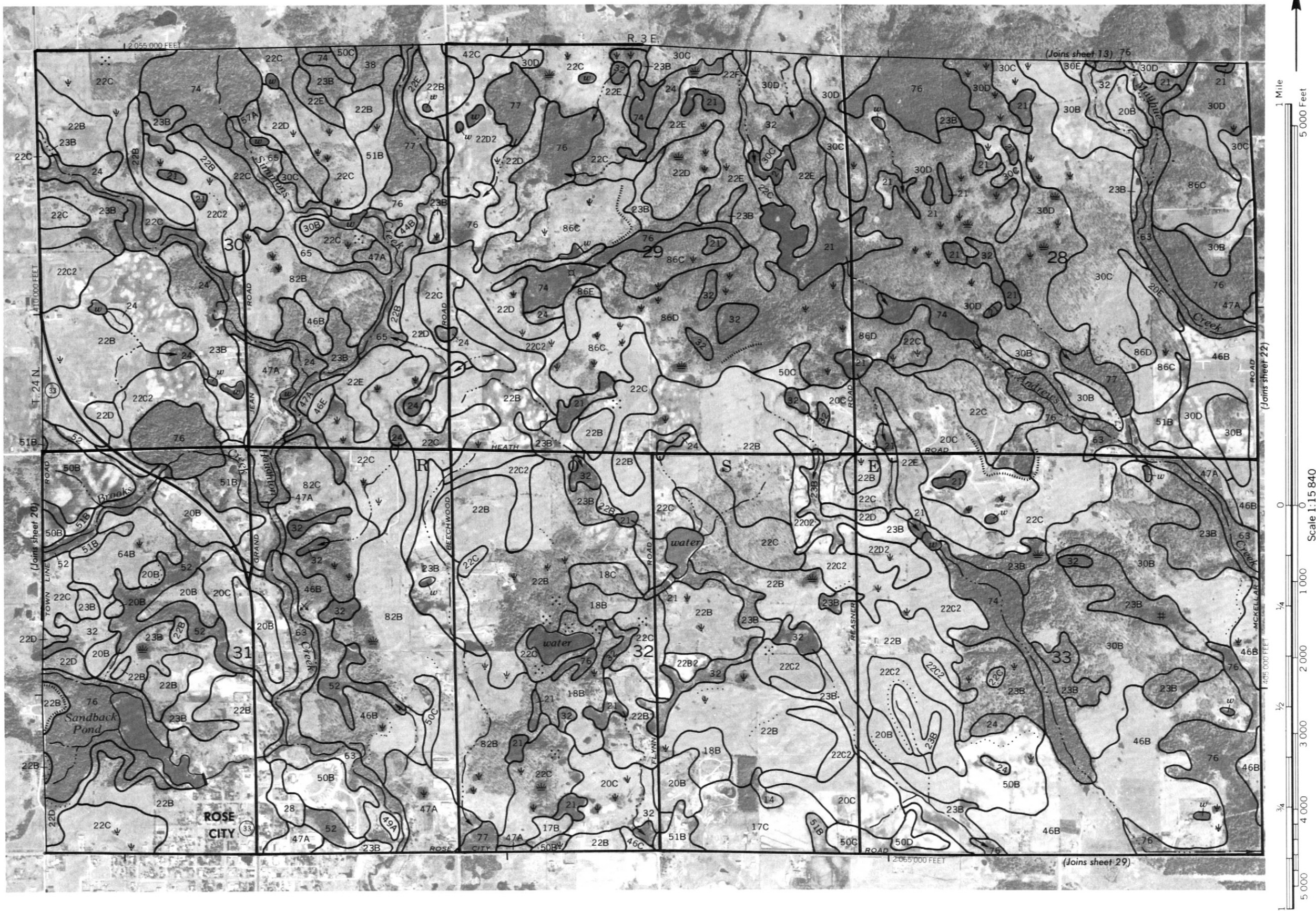
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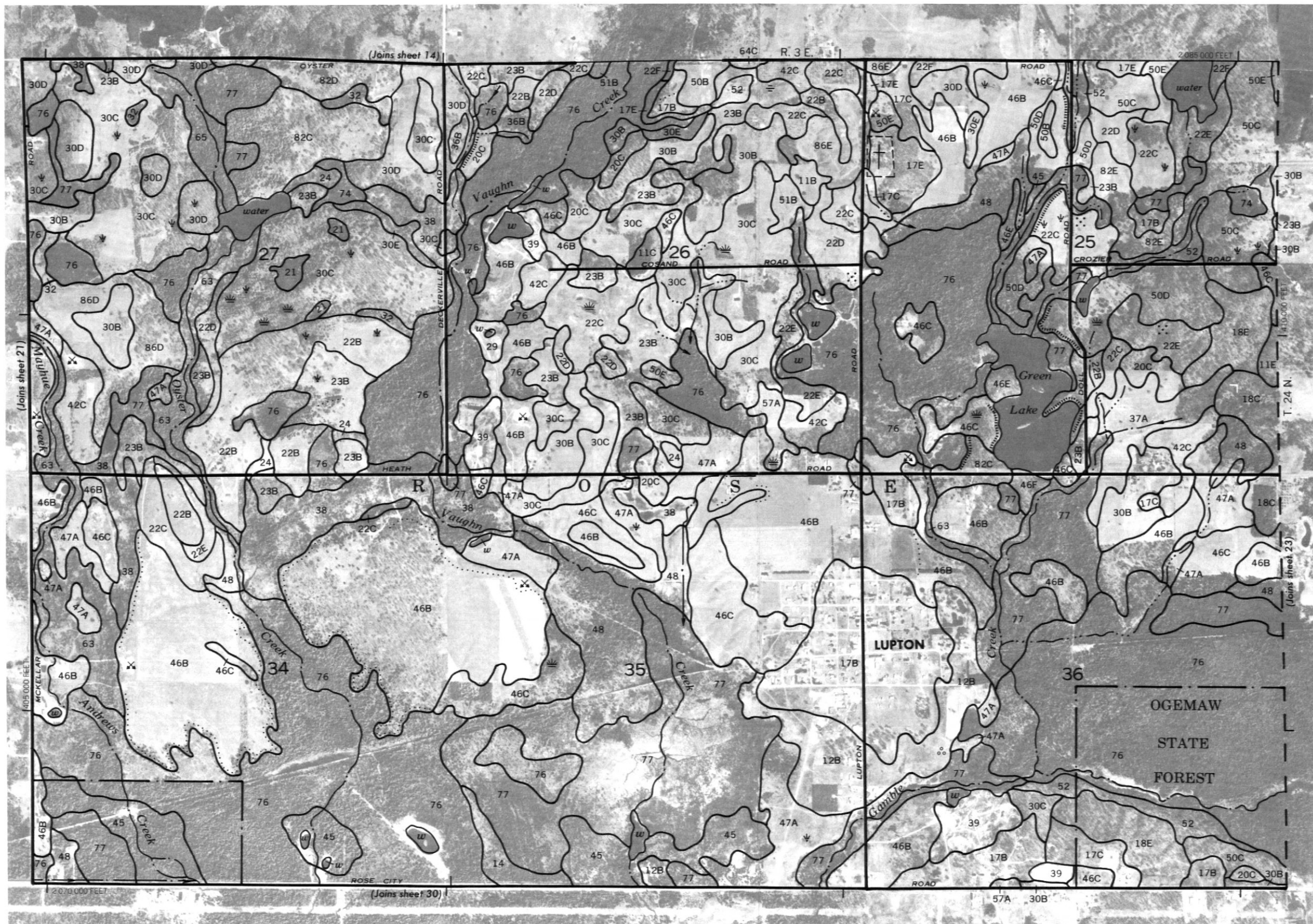
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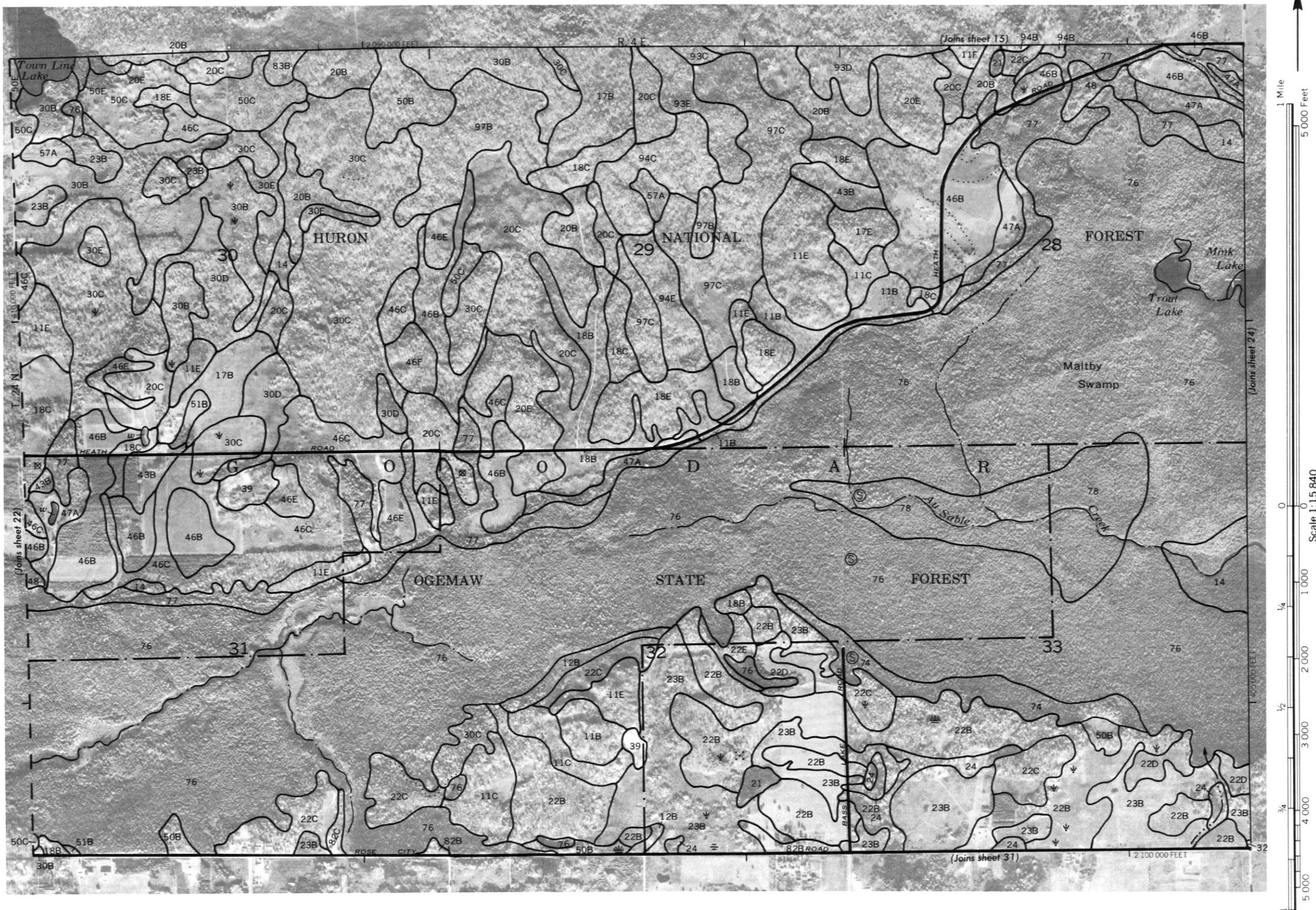
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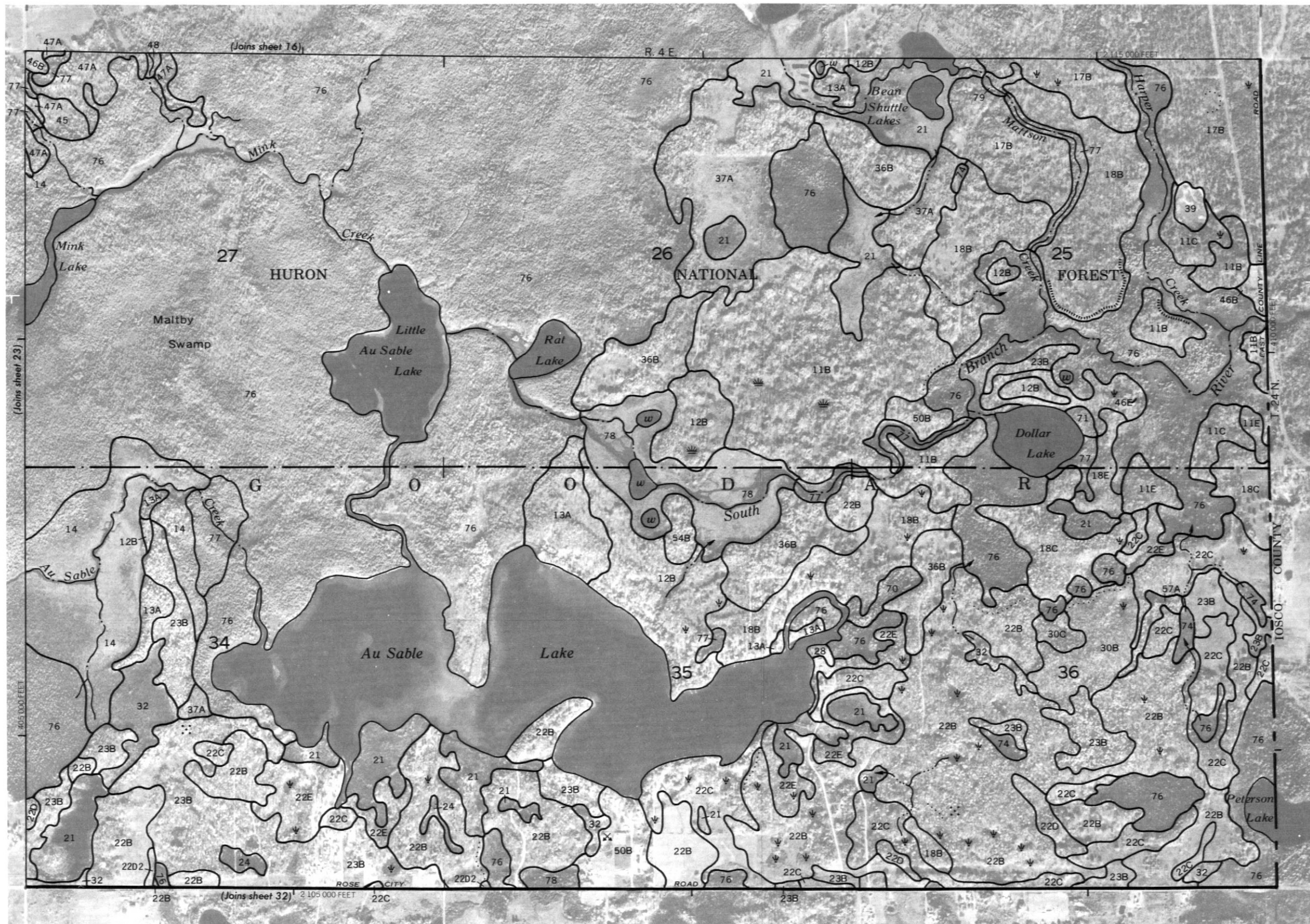
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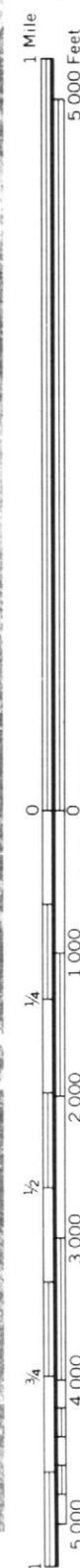
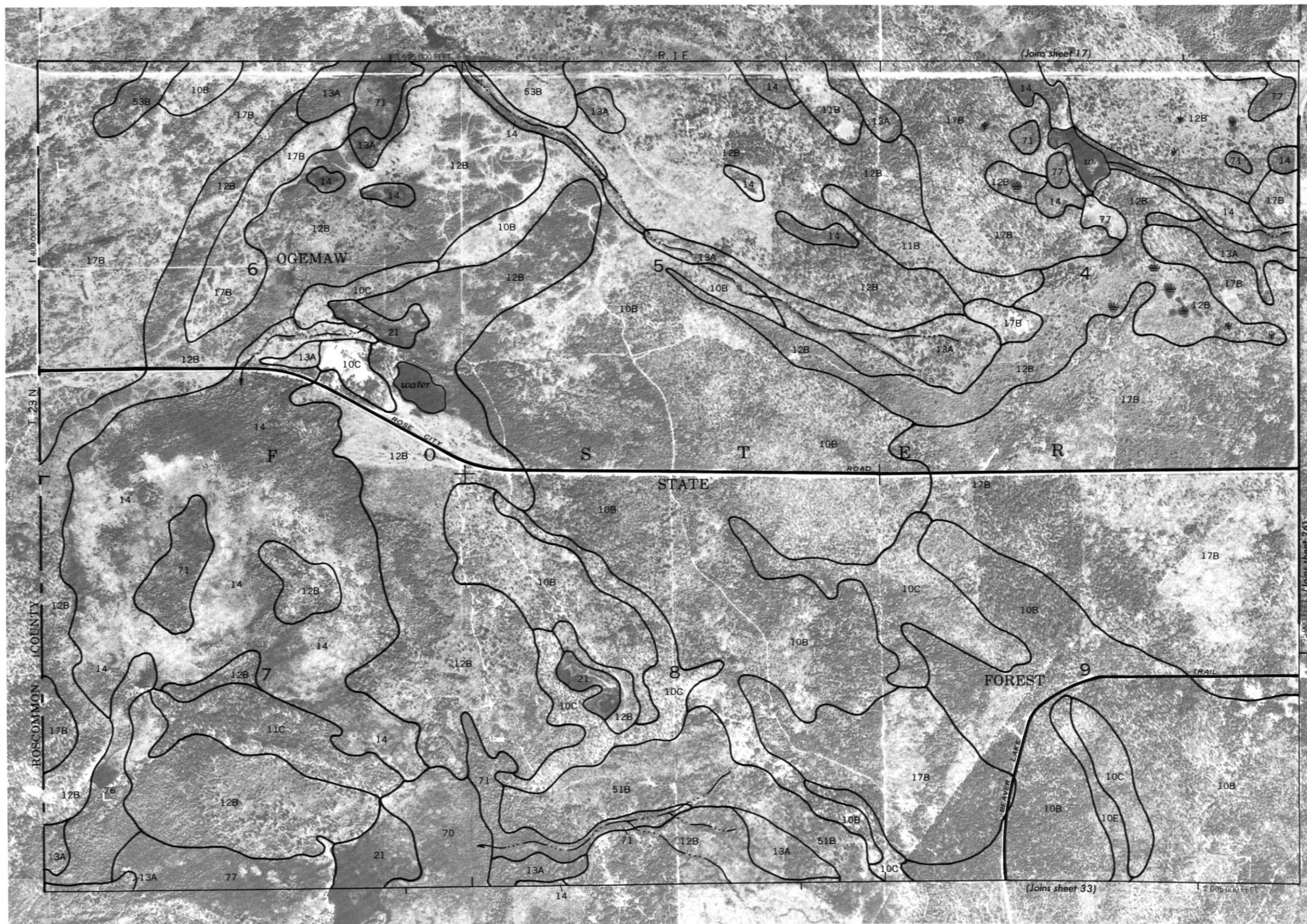
N

1 Mile
5 000 Feet

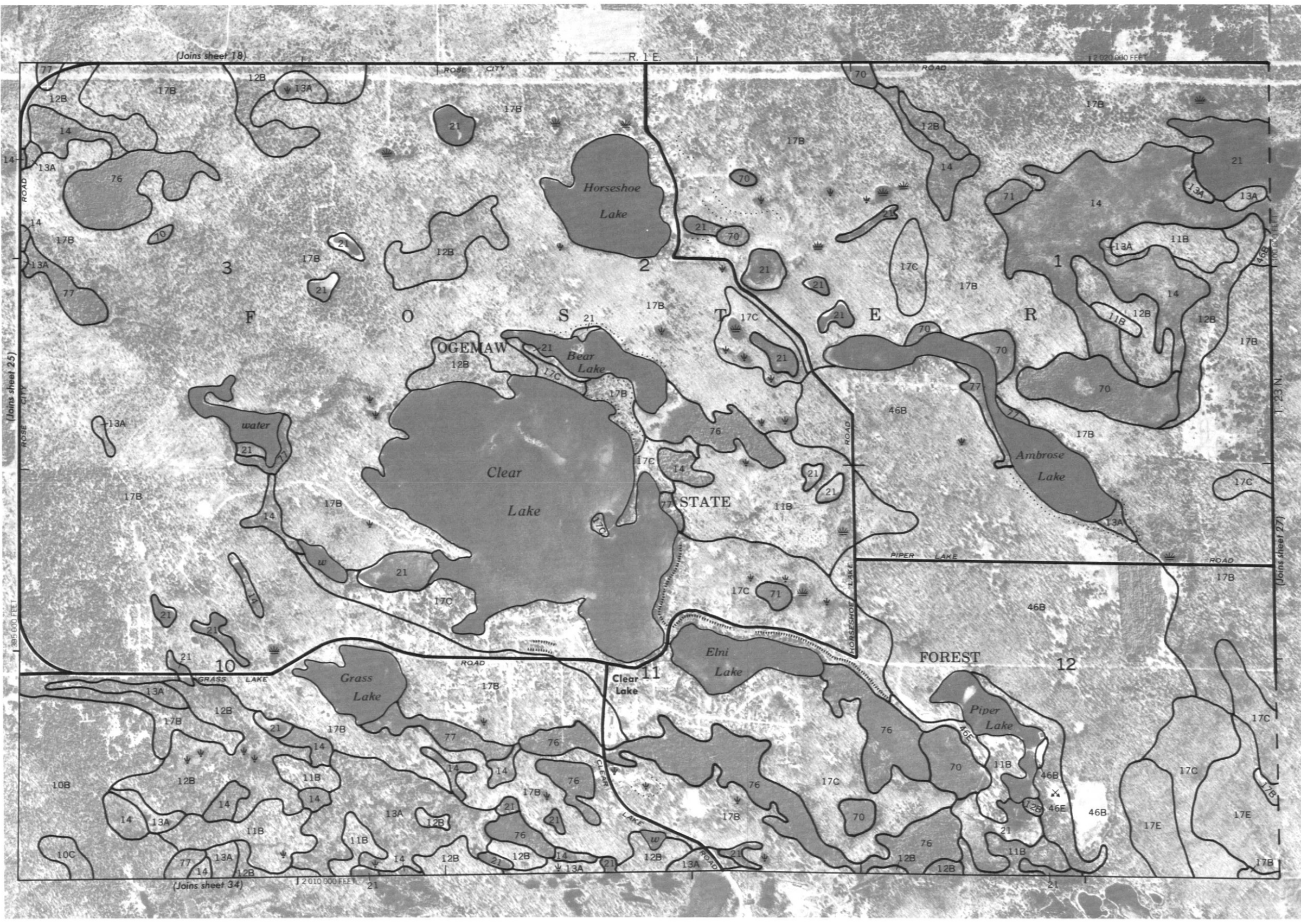
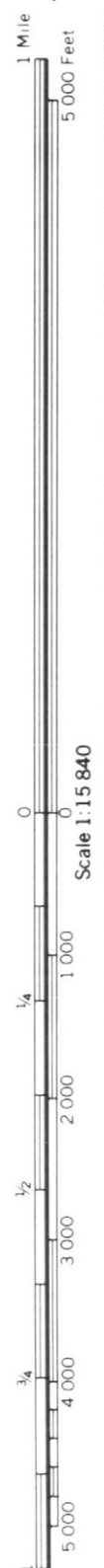
Scale 1:15 840

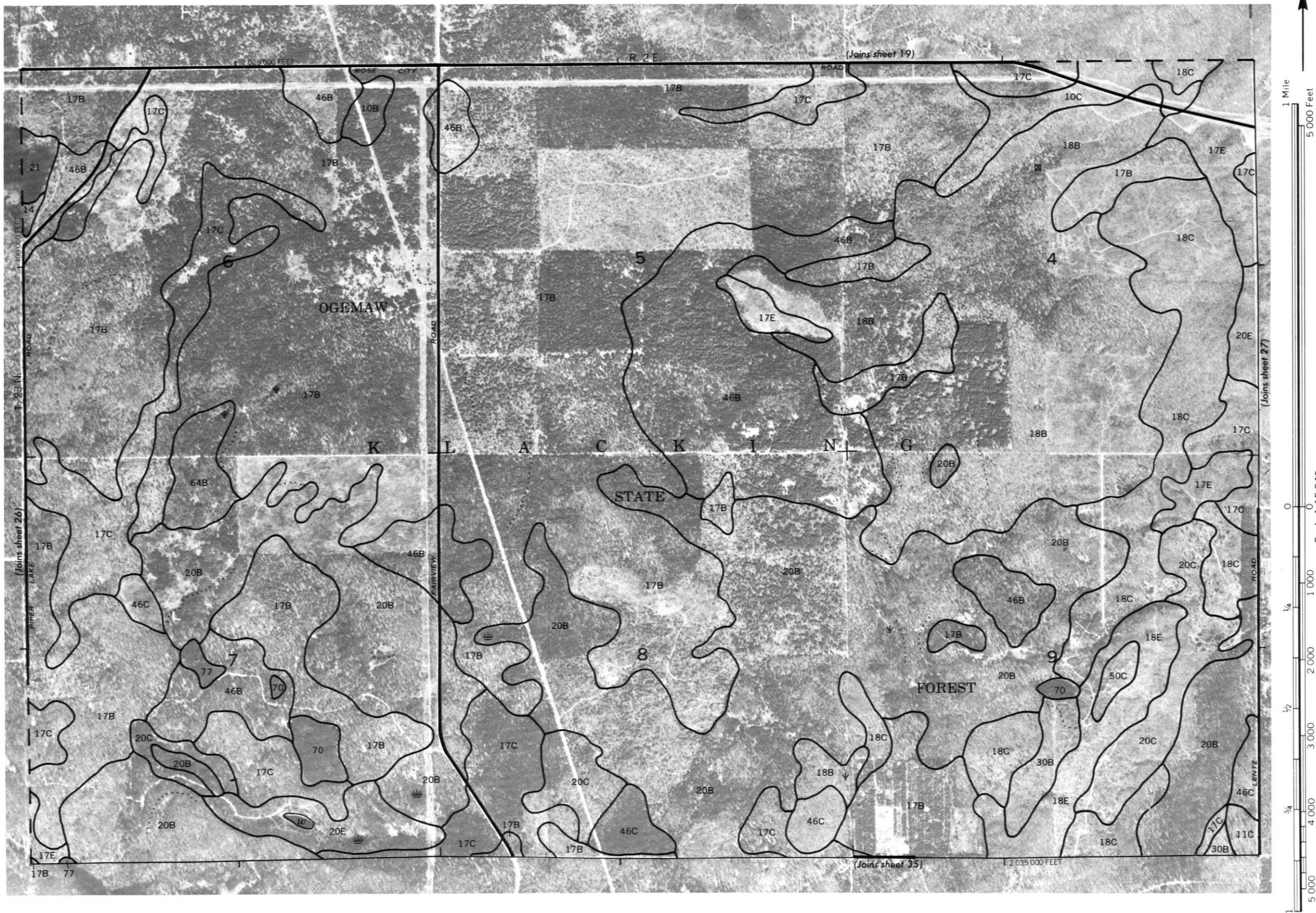
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2 000
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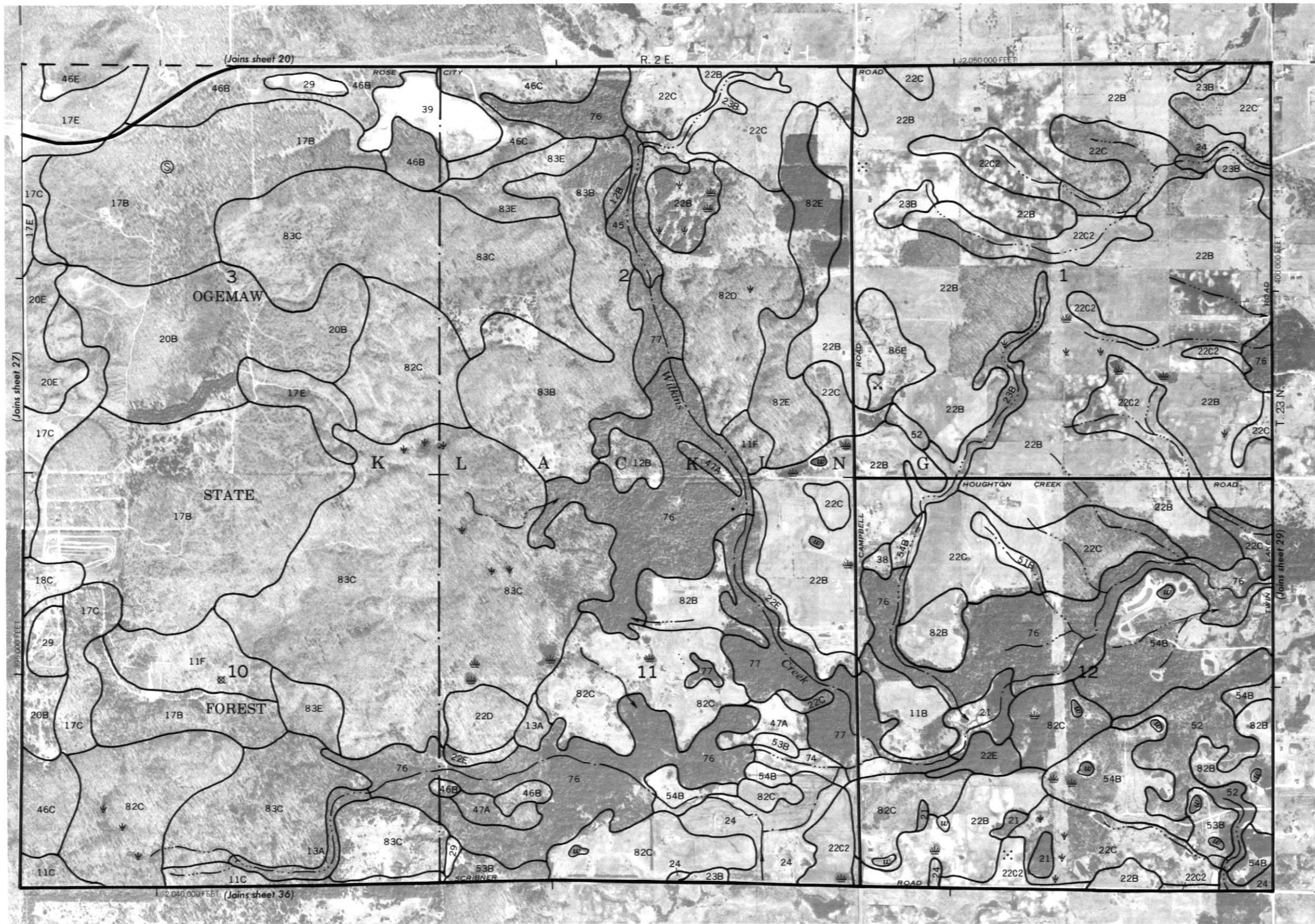


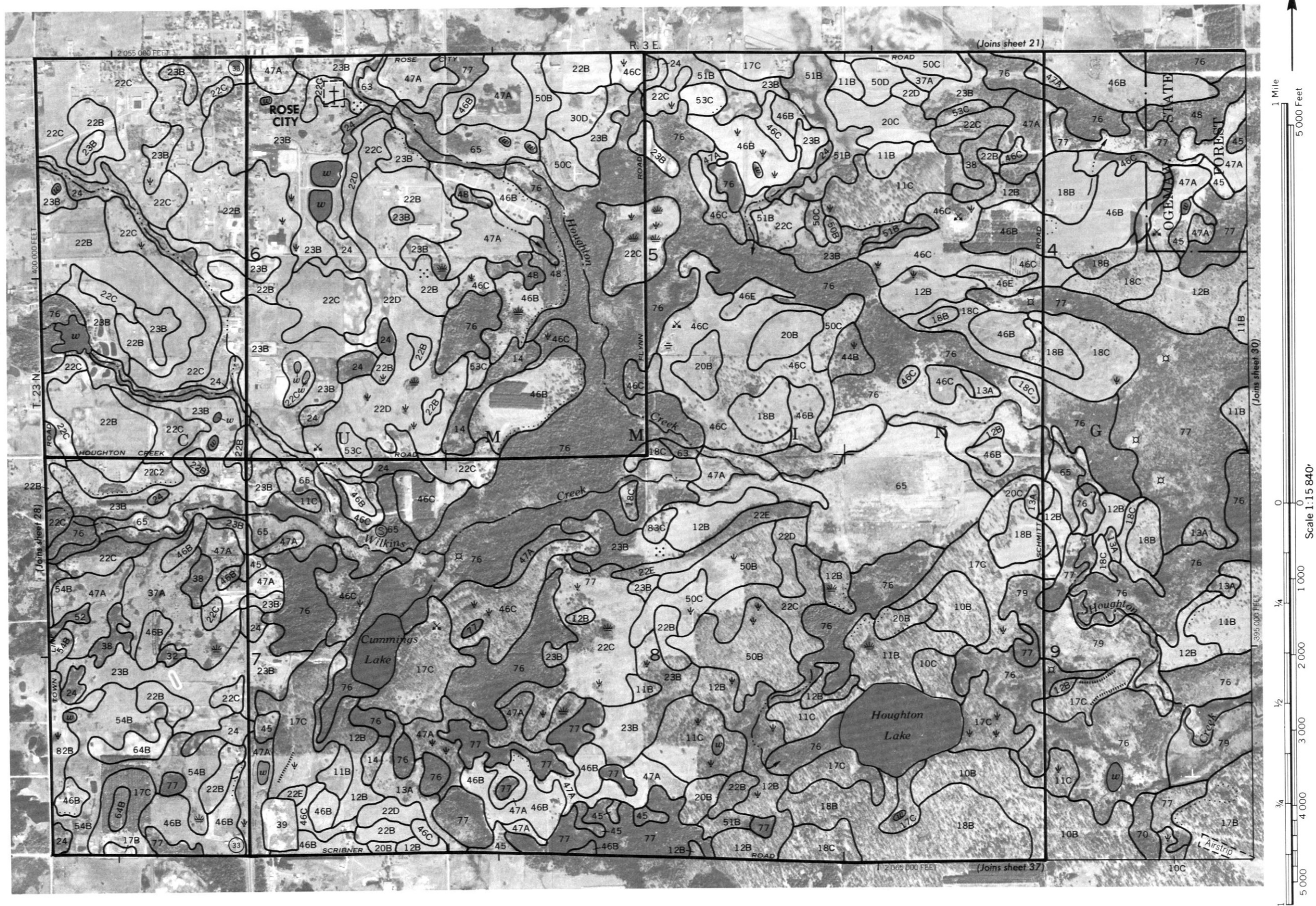


26









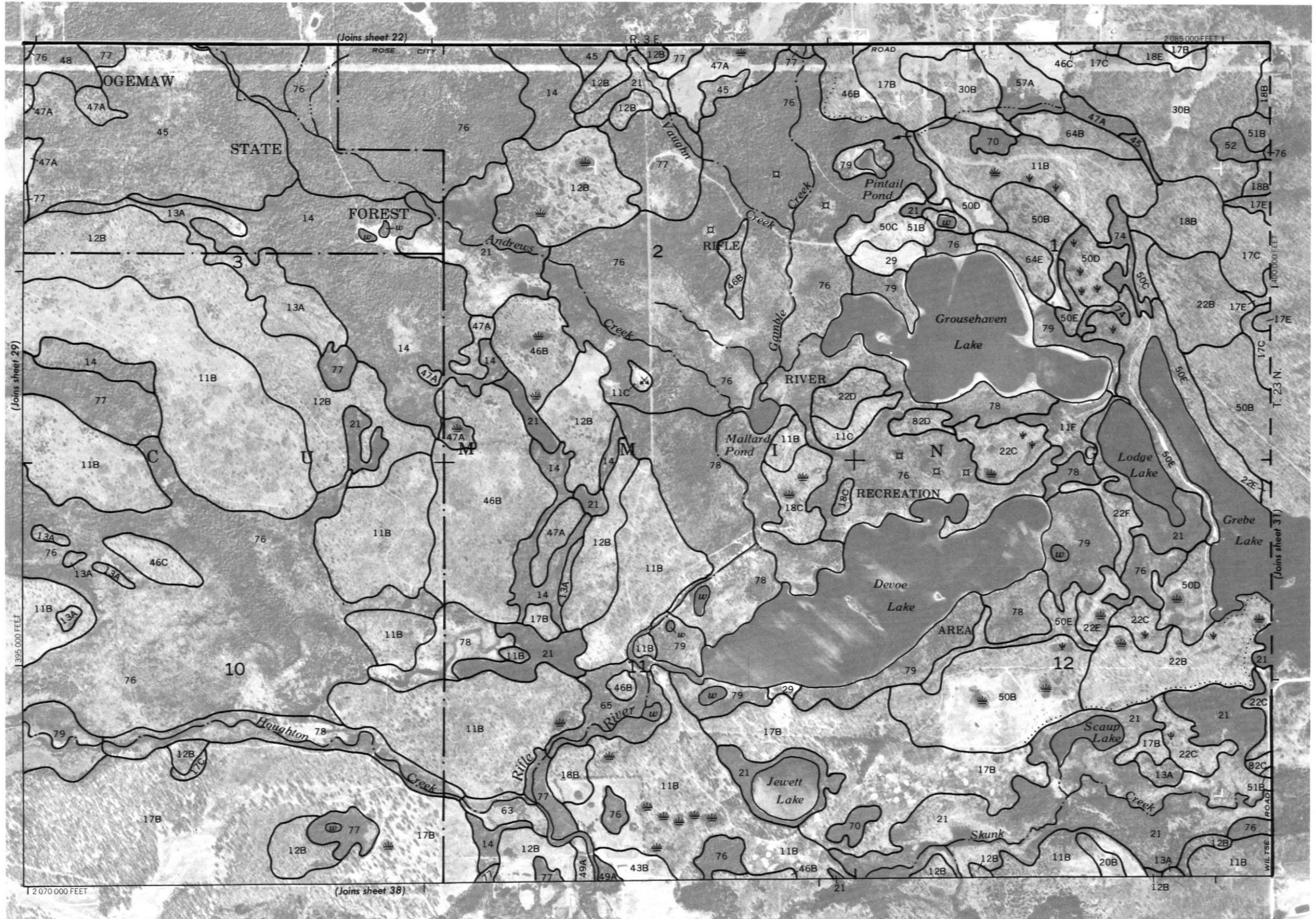
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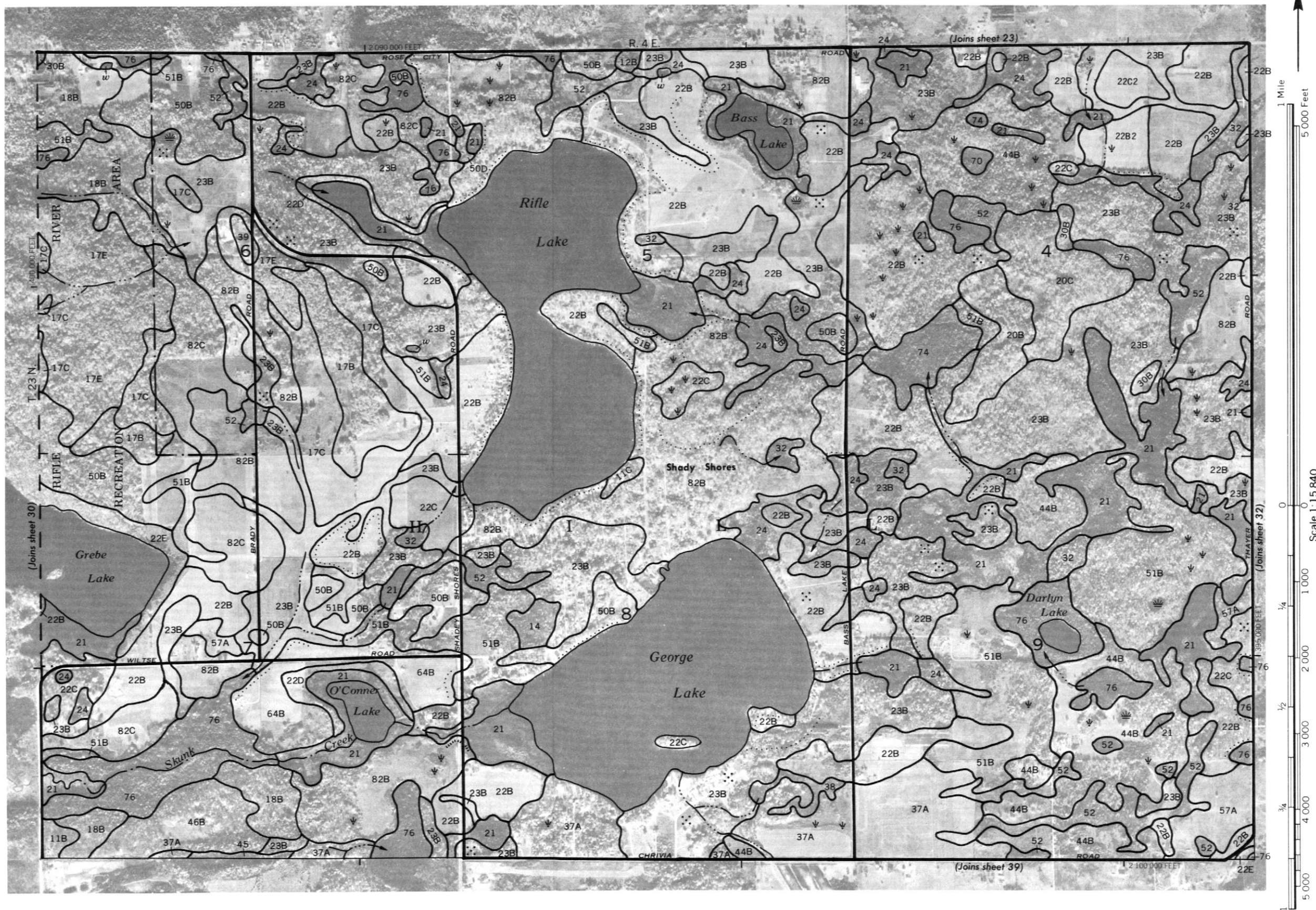
N

1 Mile
5 000 Feet

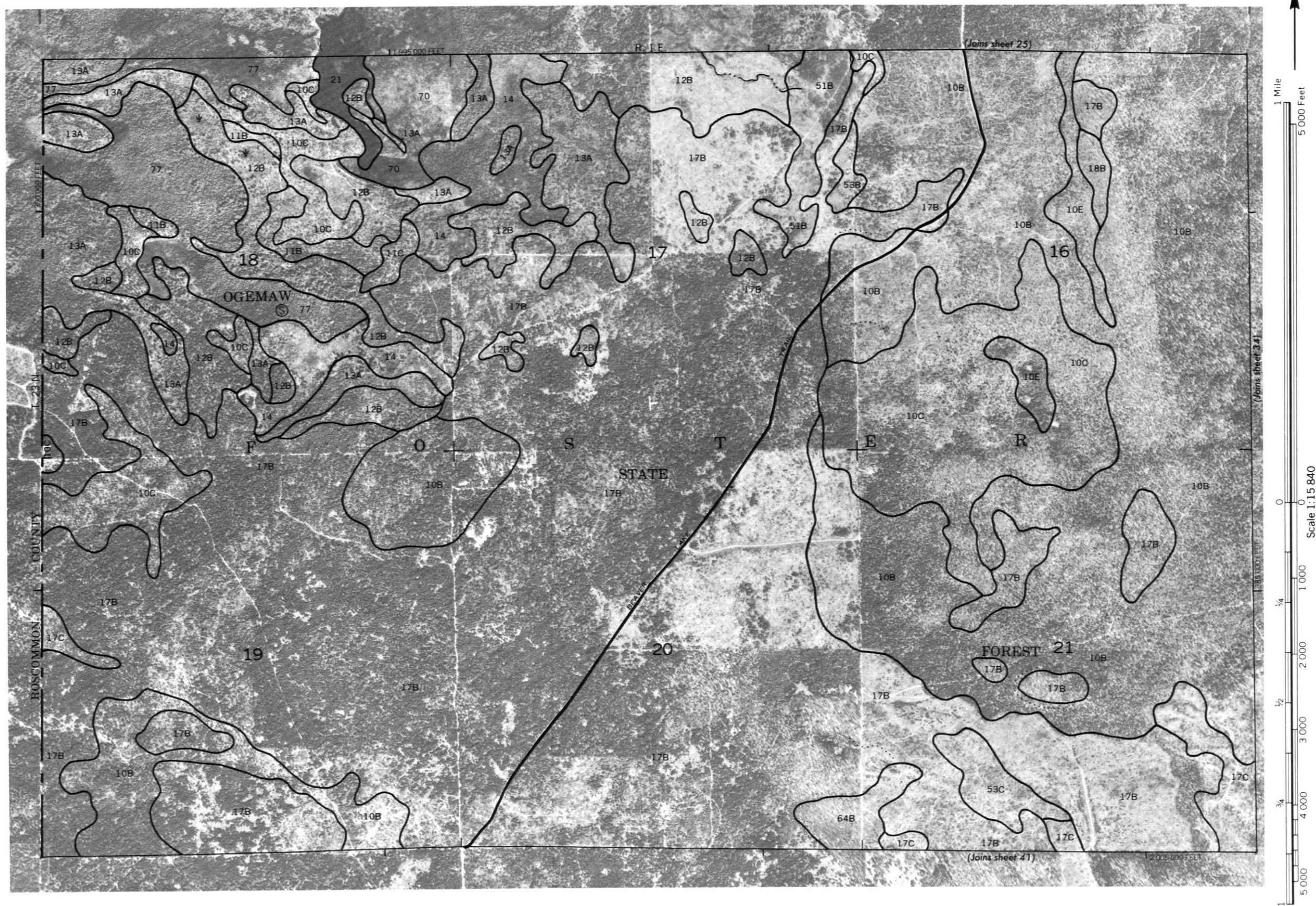
Scale 1:15 840

1 395 000 FEET
1 000
2 000
3 000
4 000
5 000



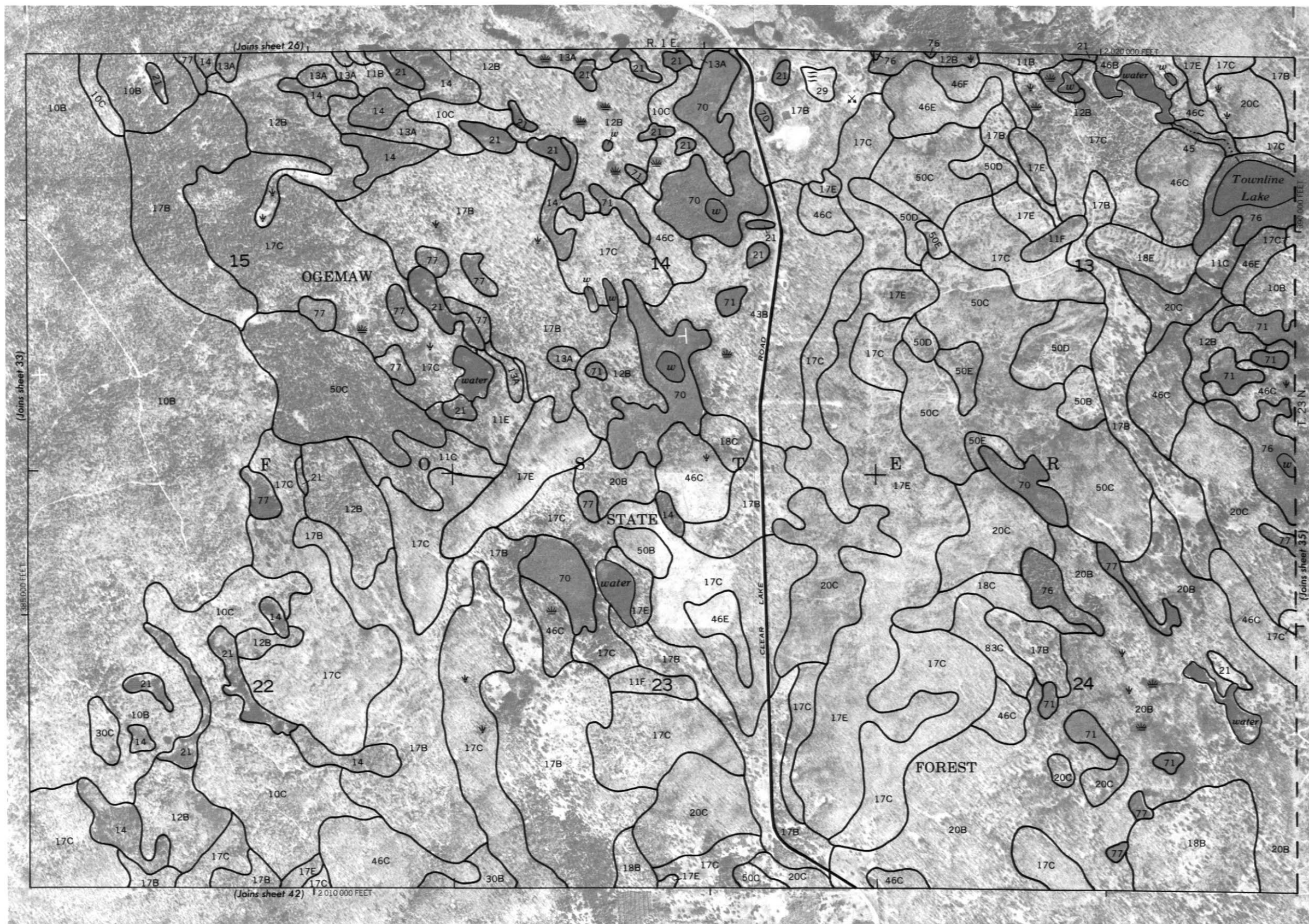


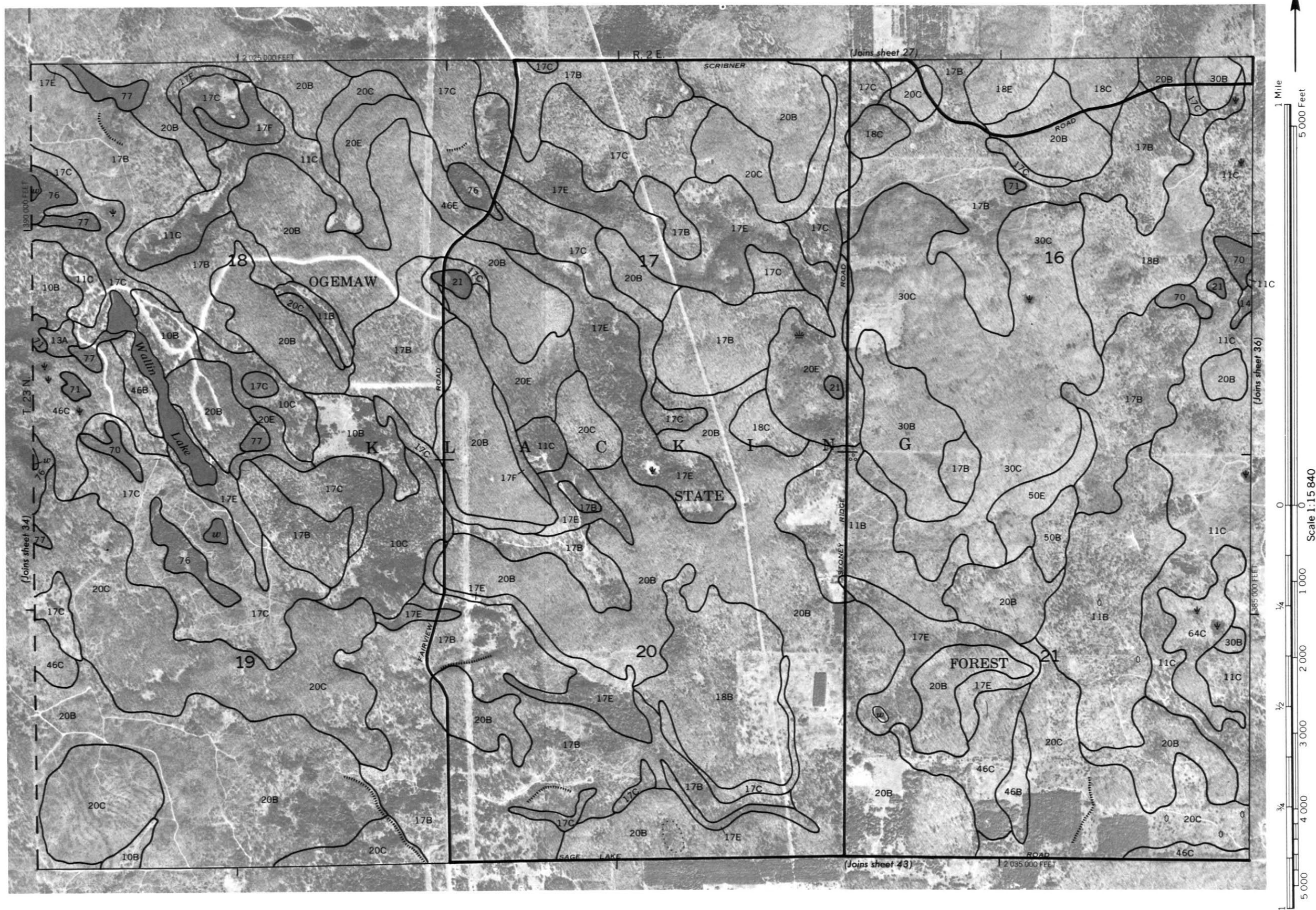




1 Mile
5 000 Feet

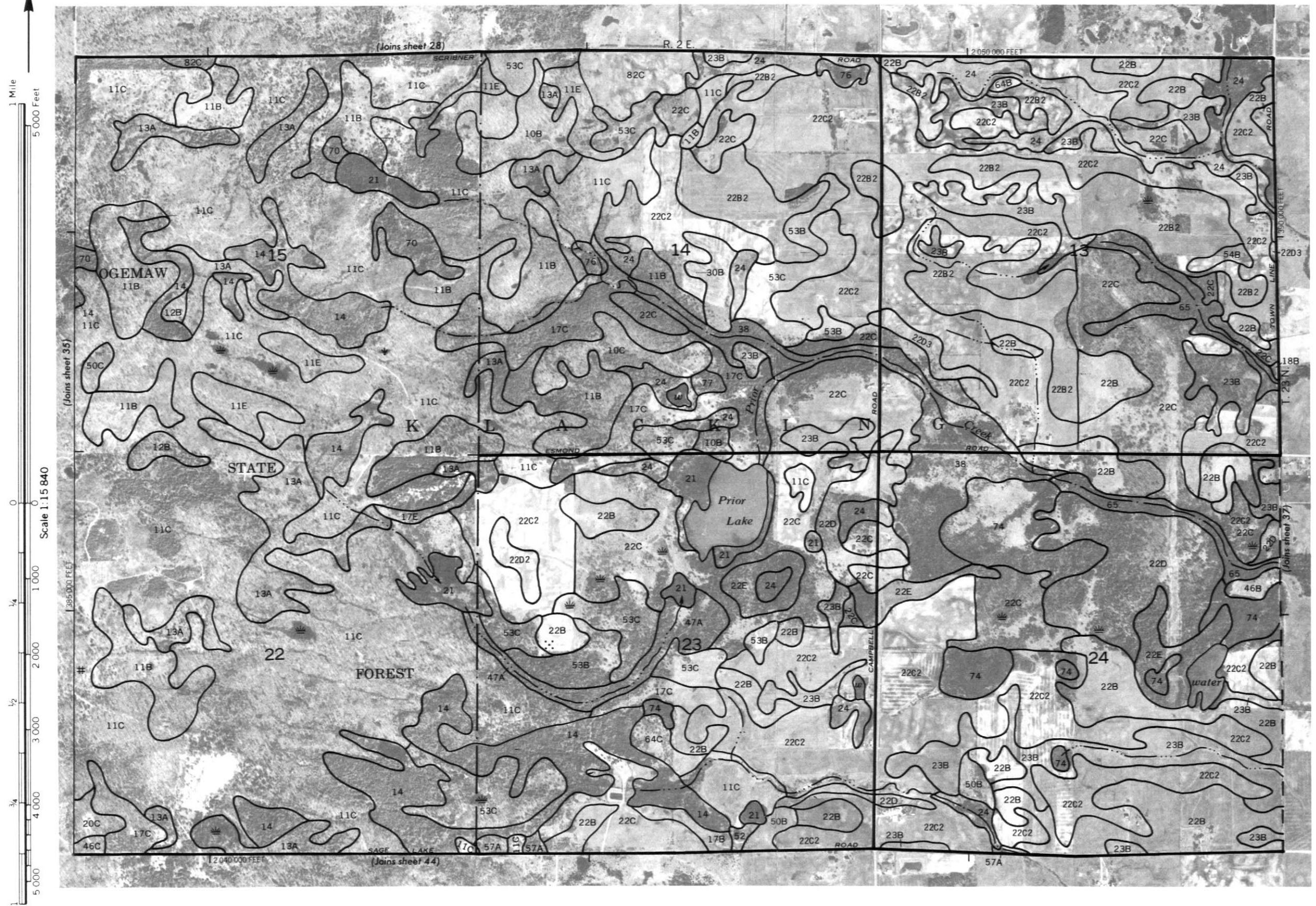
Scale 1:15 840

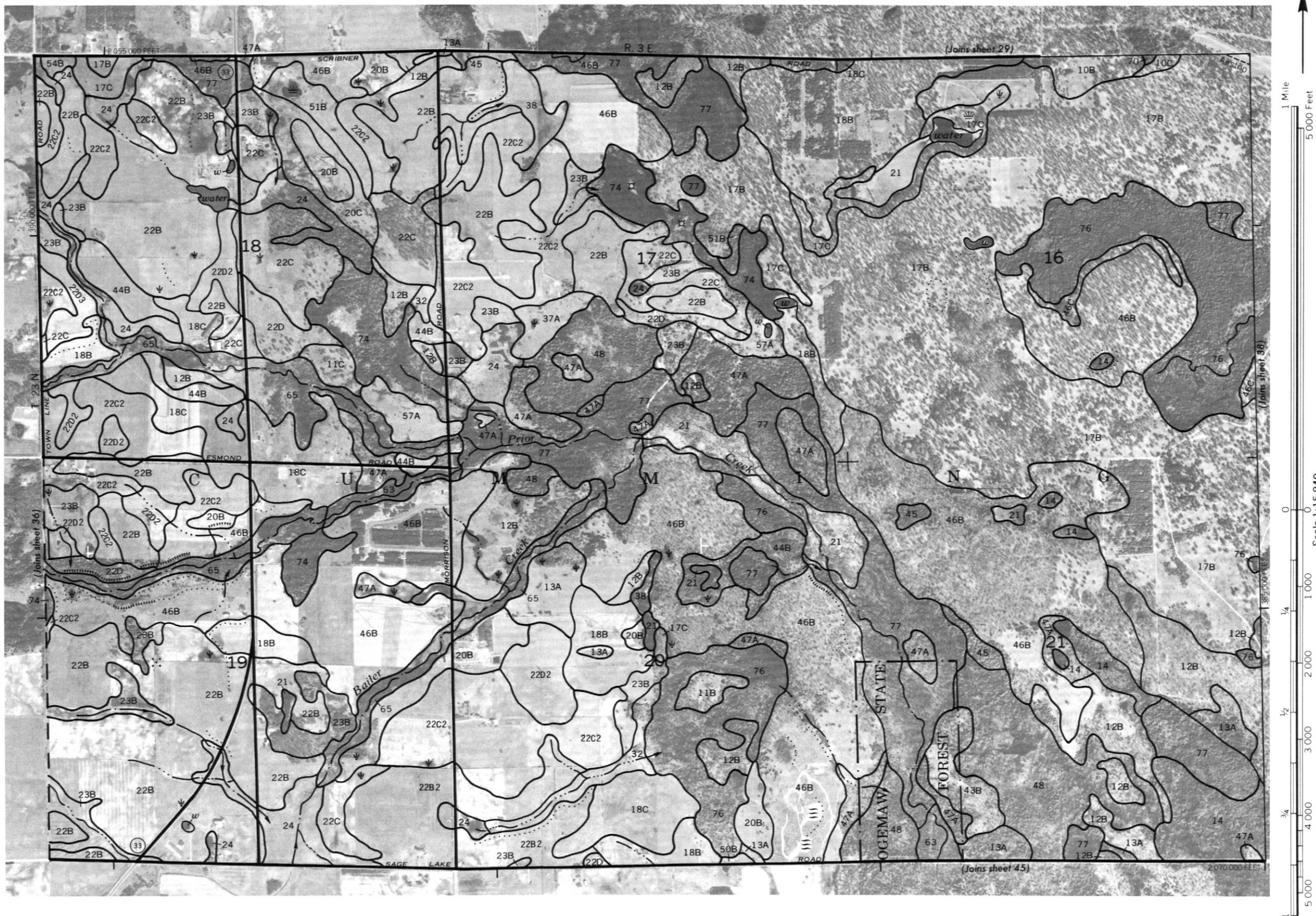


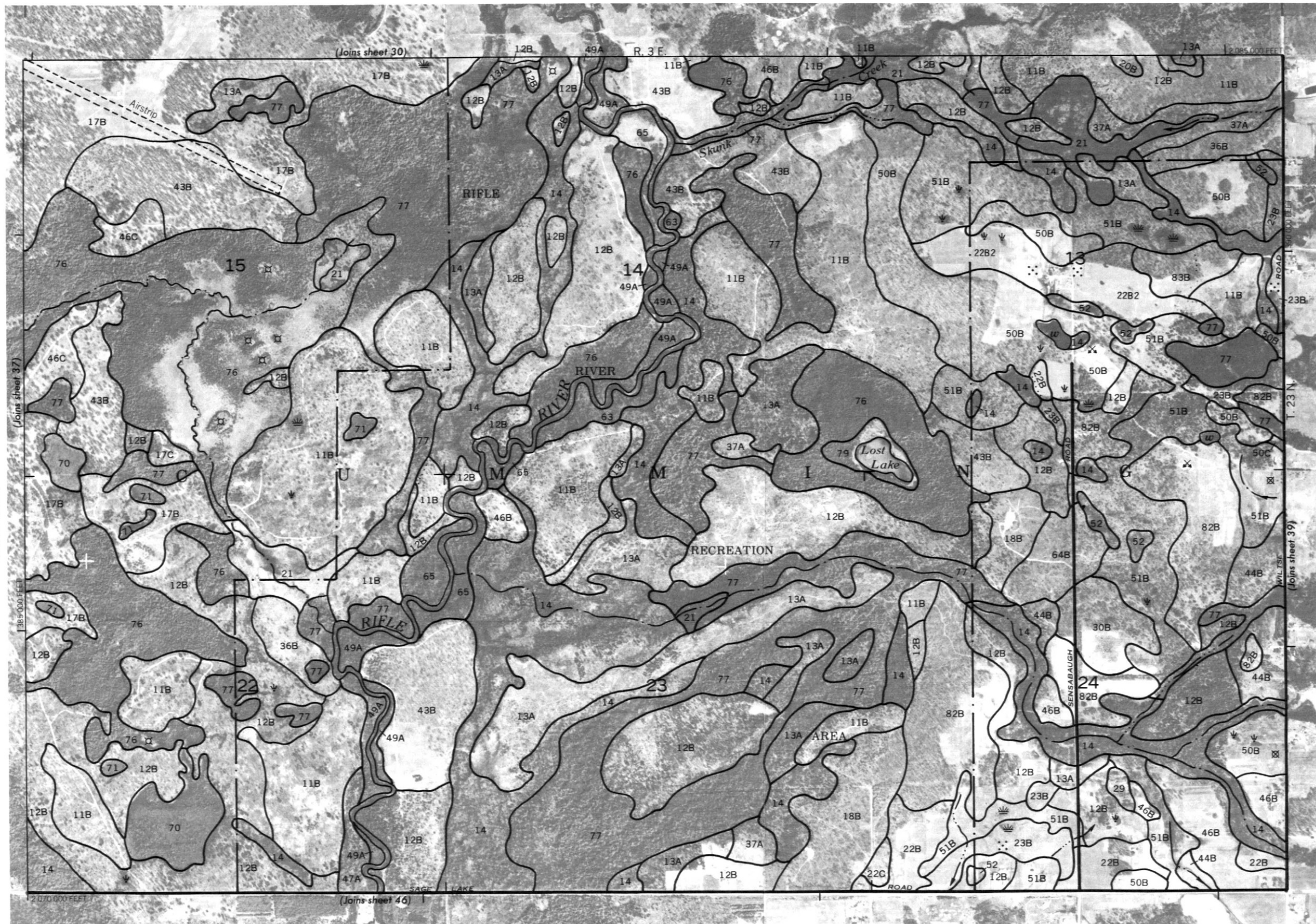


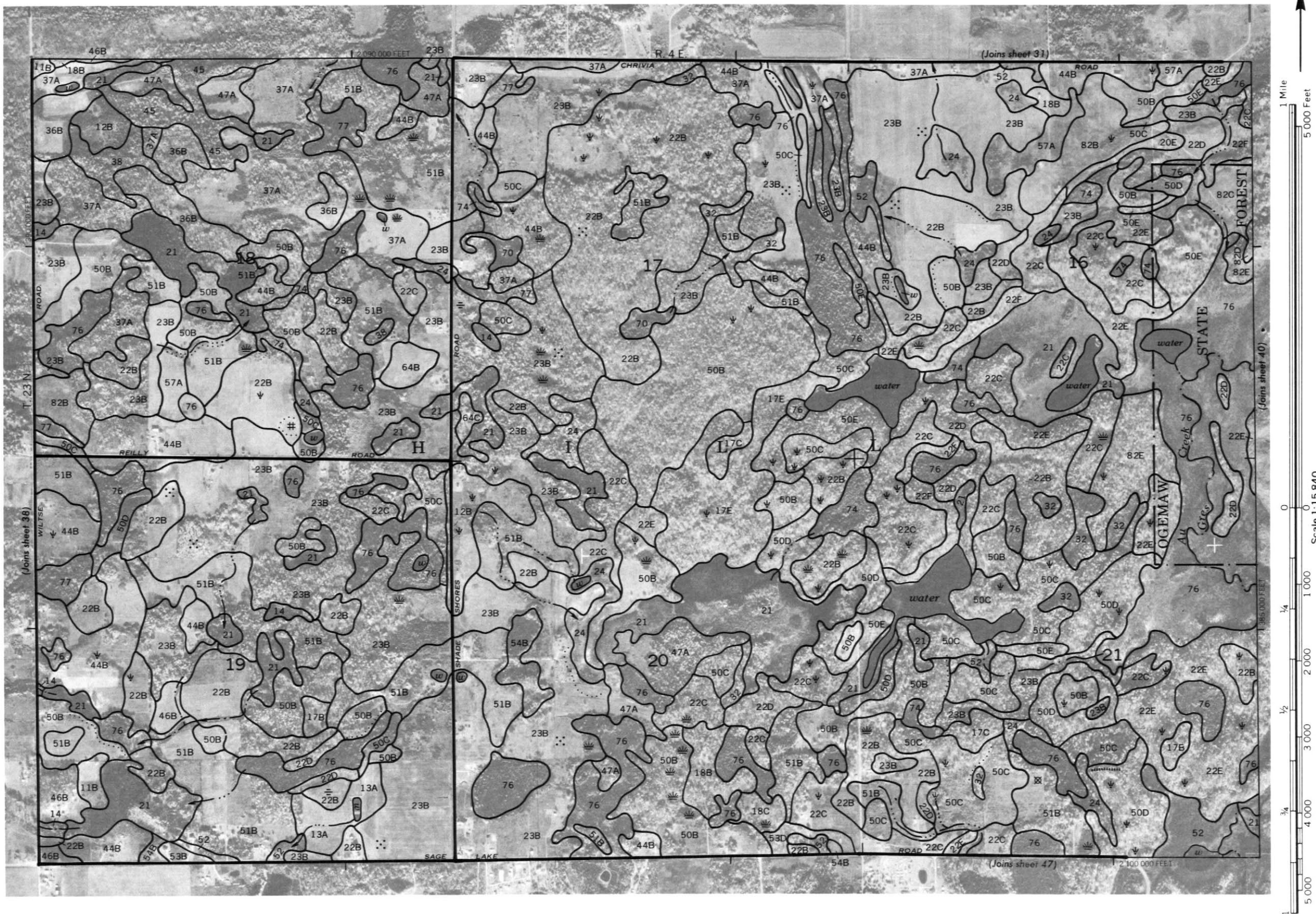
36

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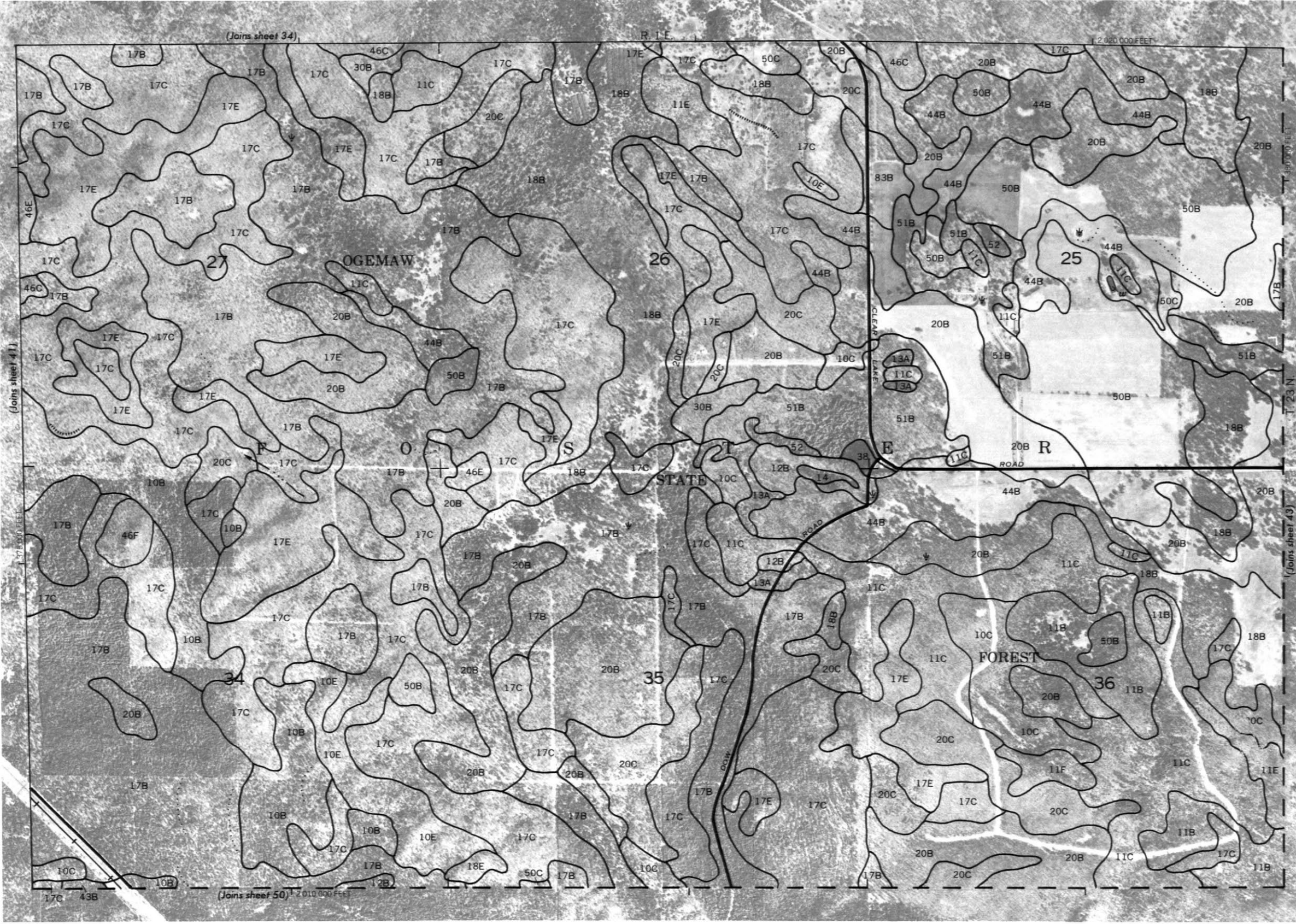
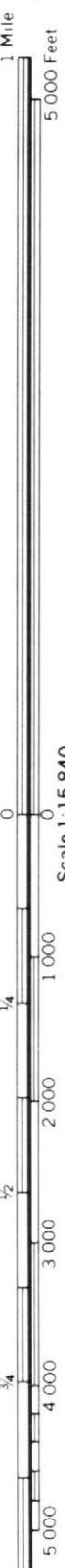




N









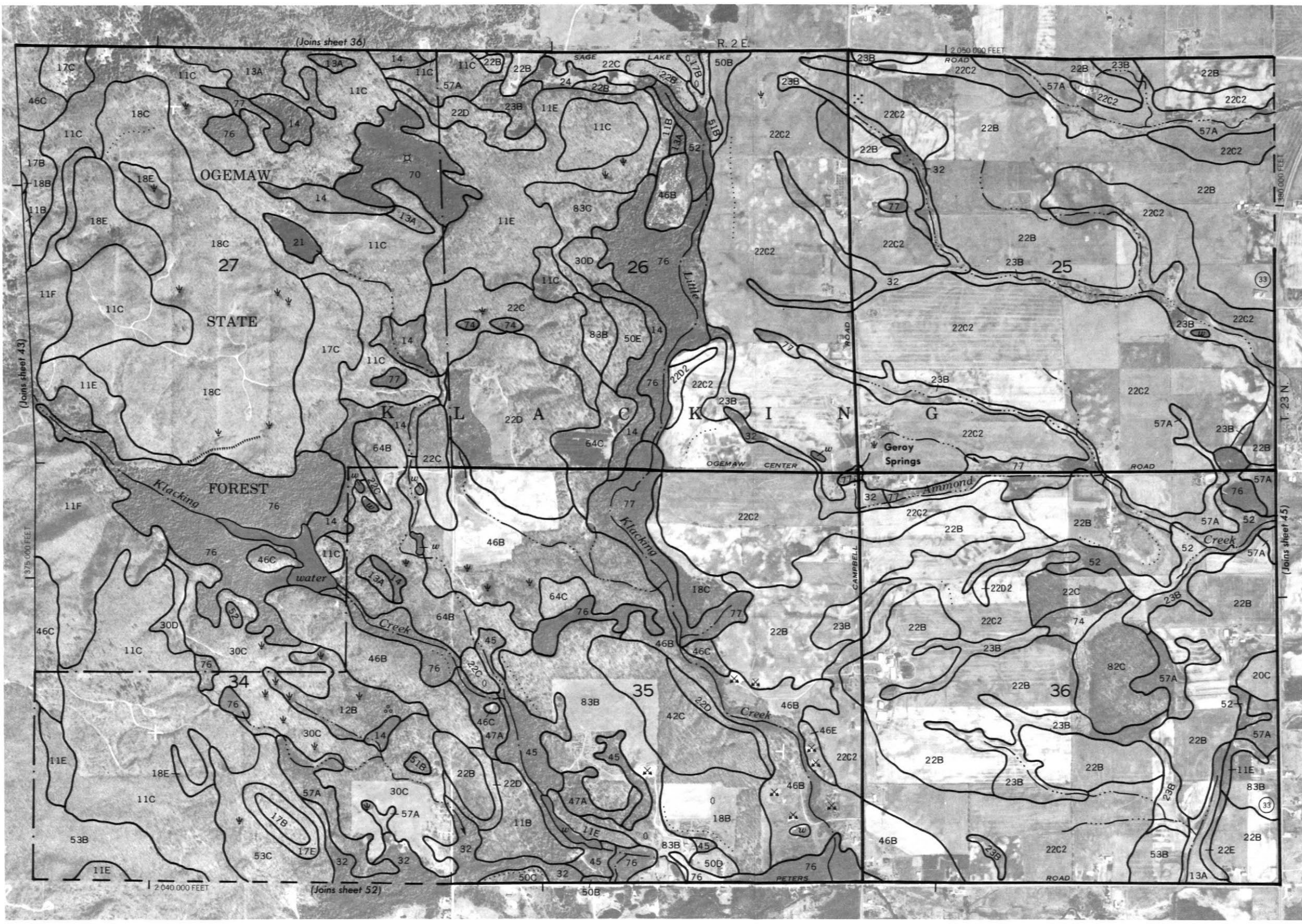
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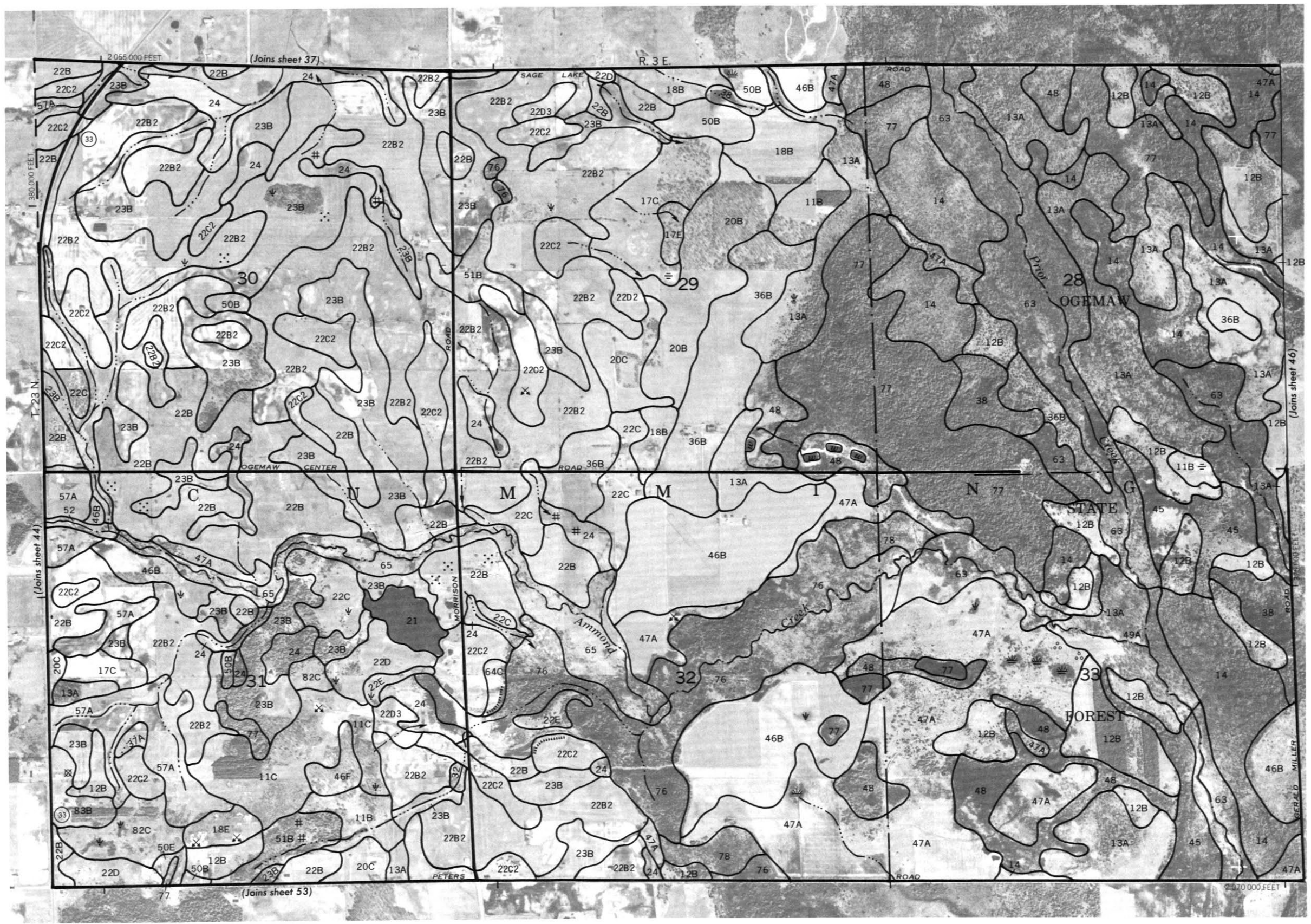


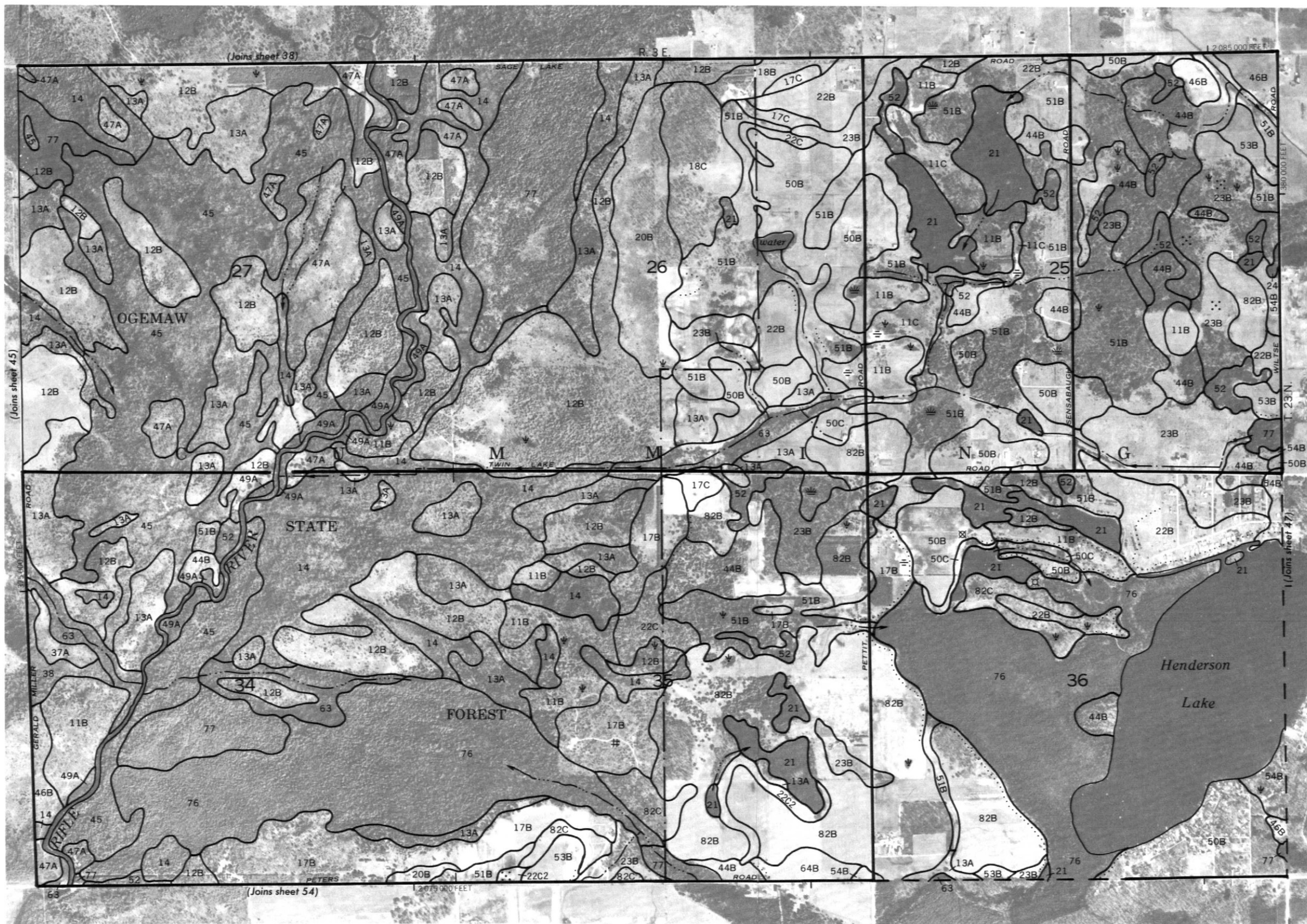
1 Mile
5 000 Feet

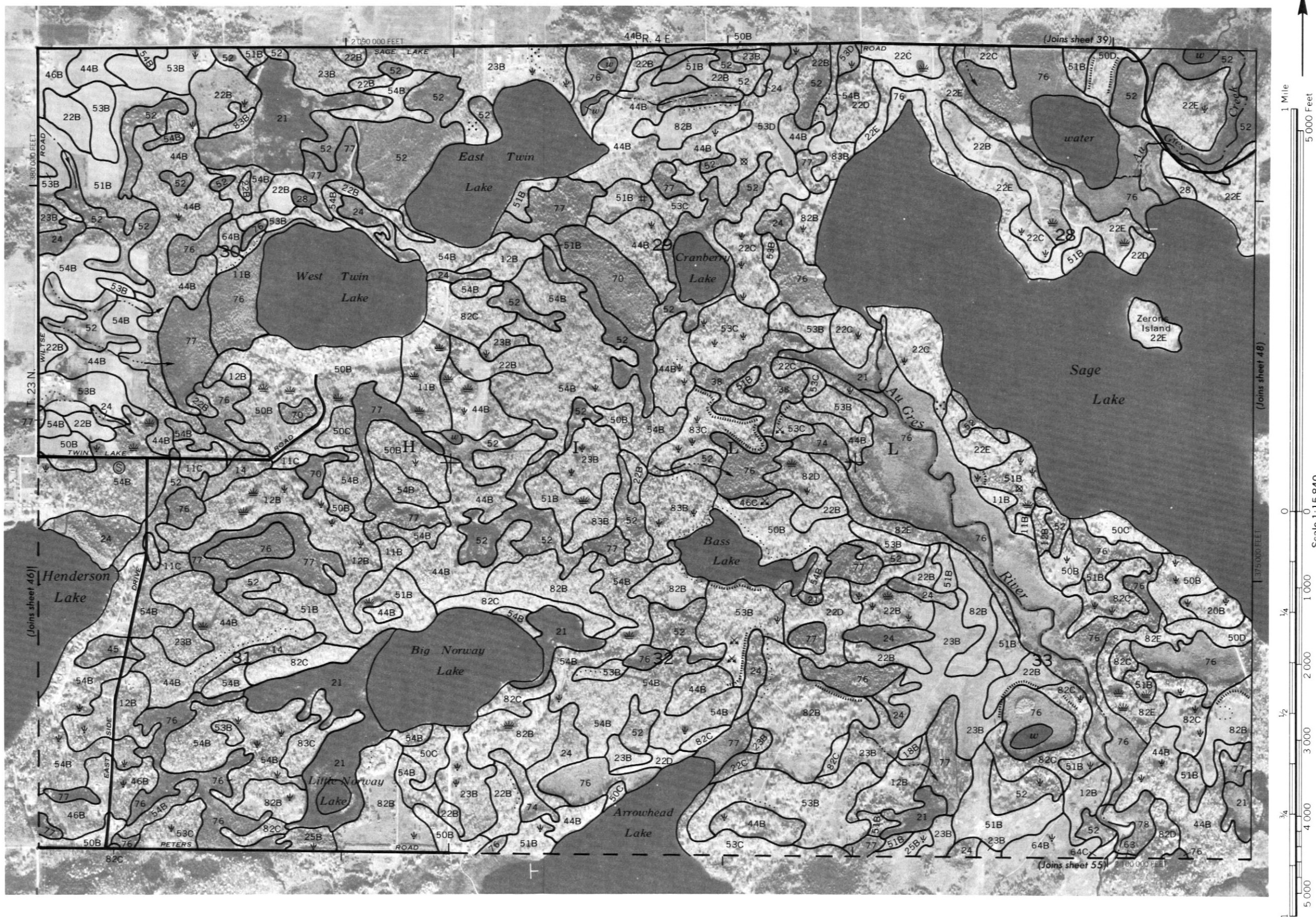
Scale 1:15 840

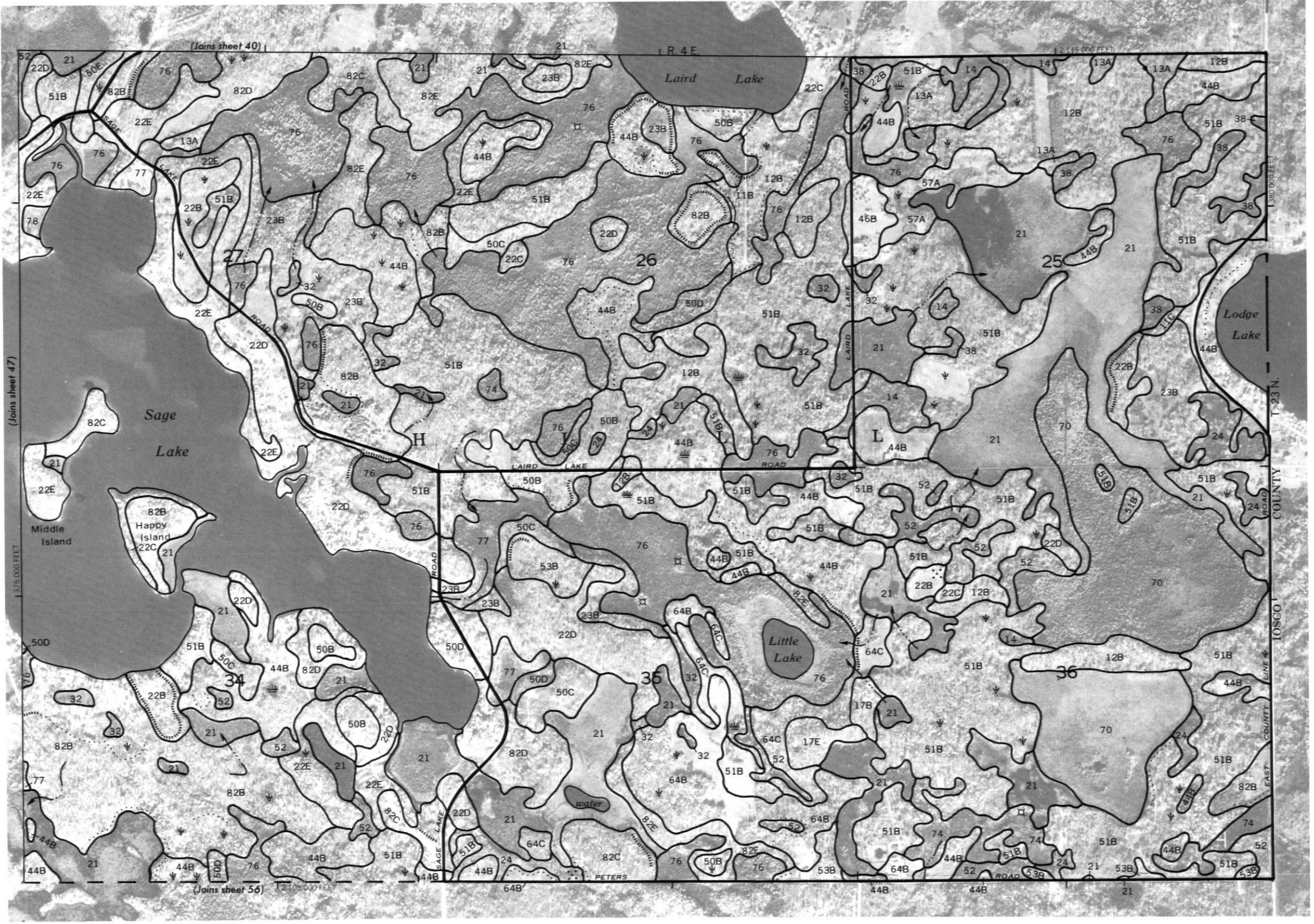
1
1/2
3/4
2 000
3 000
4 000
5 000

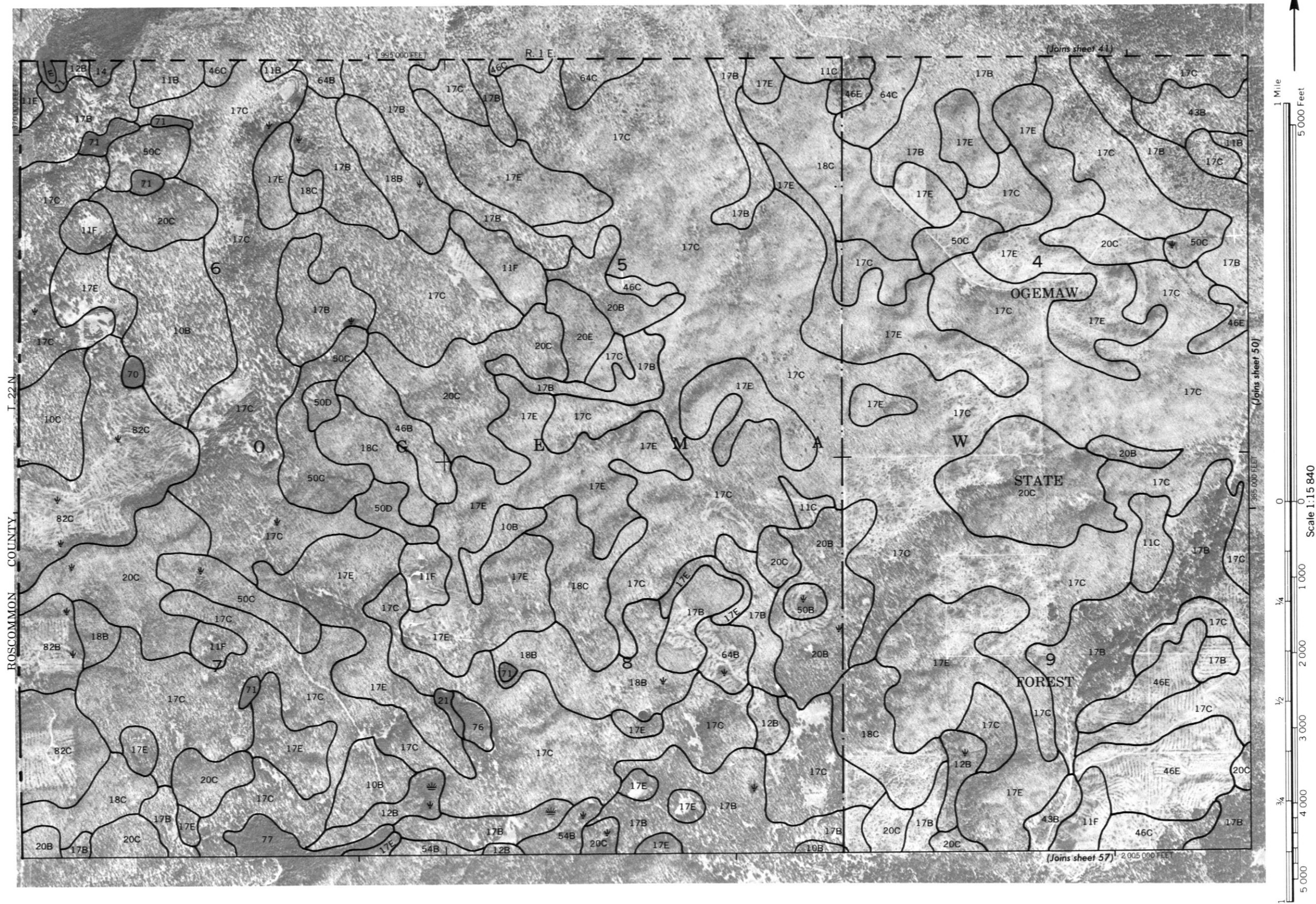


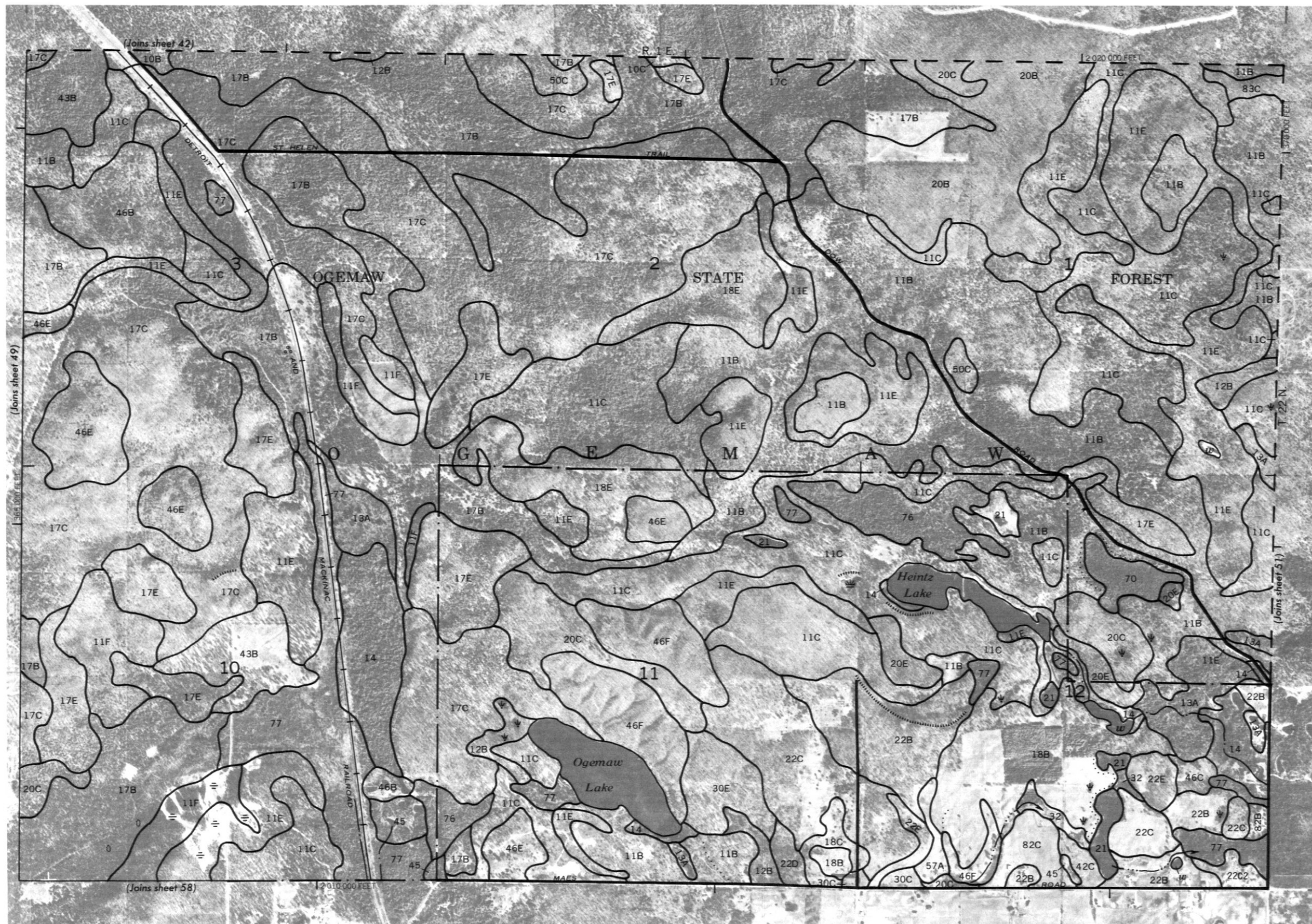














52

N

1 Mile
5 000 Feet

Scale 1:15 840

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1 000

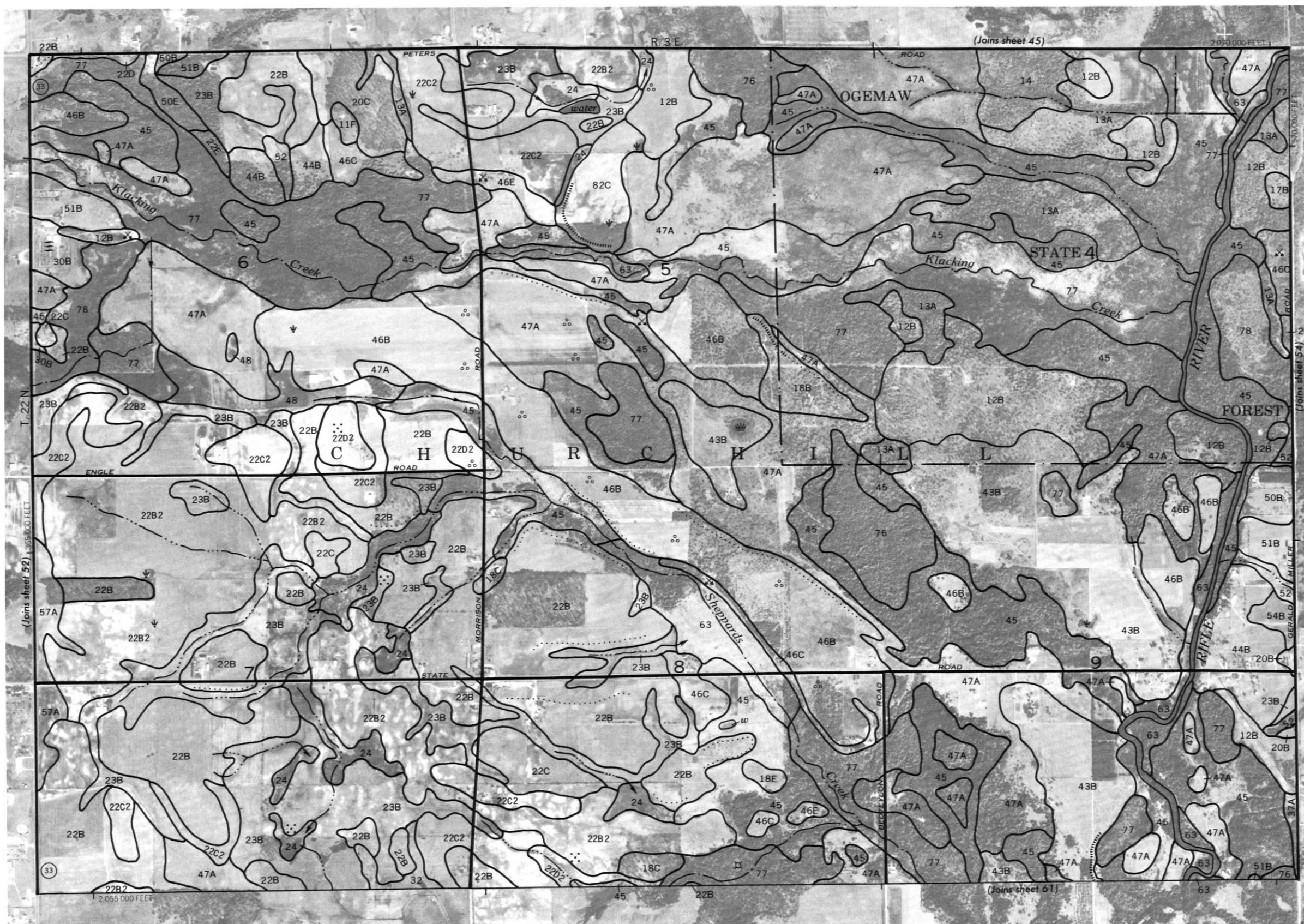
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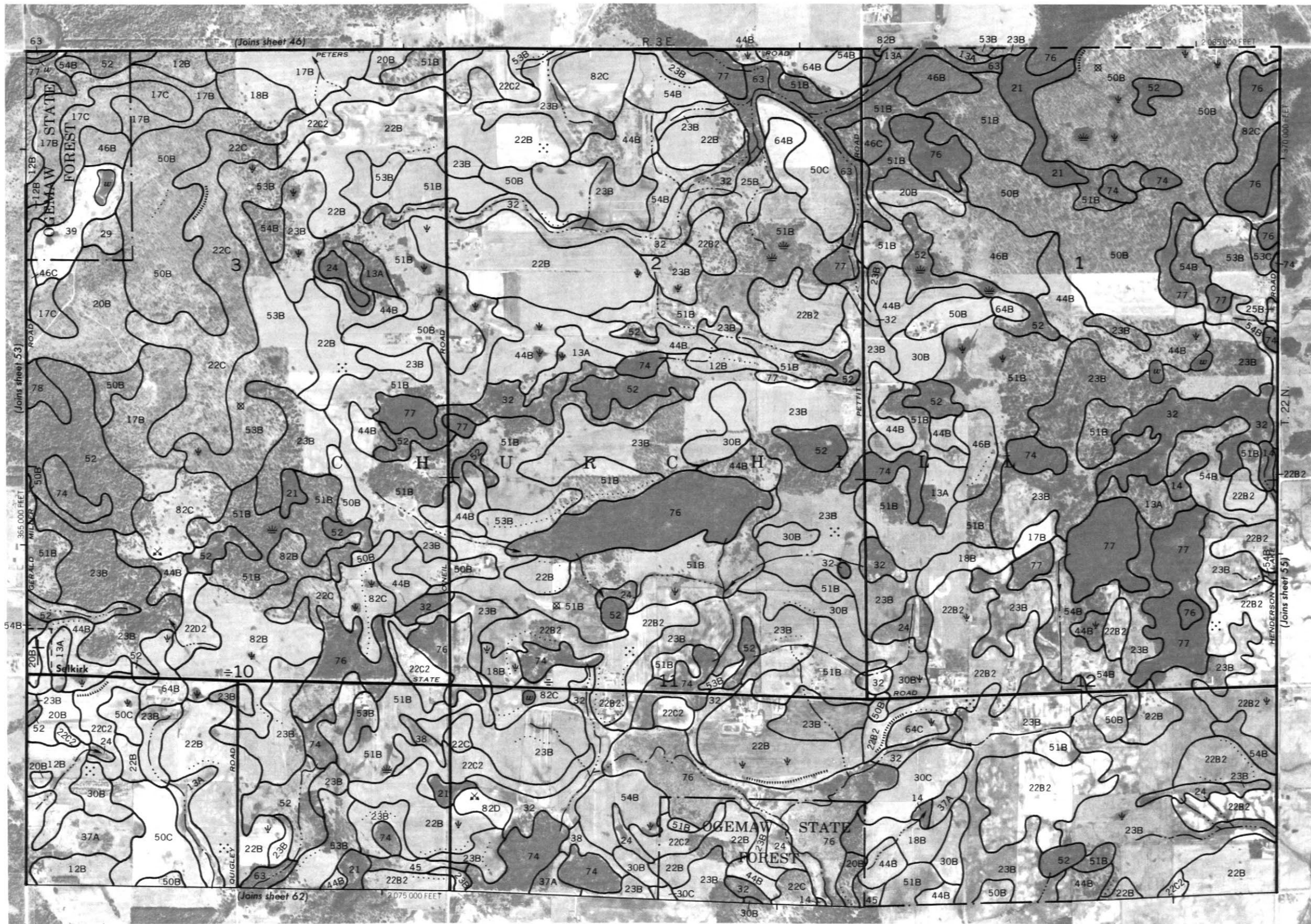
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3 000

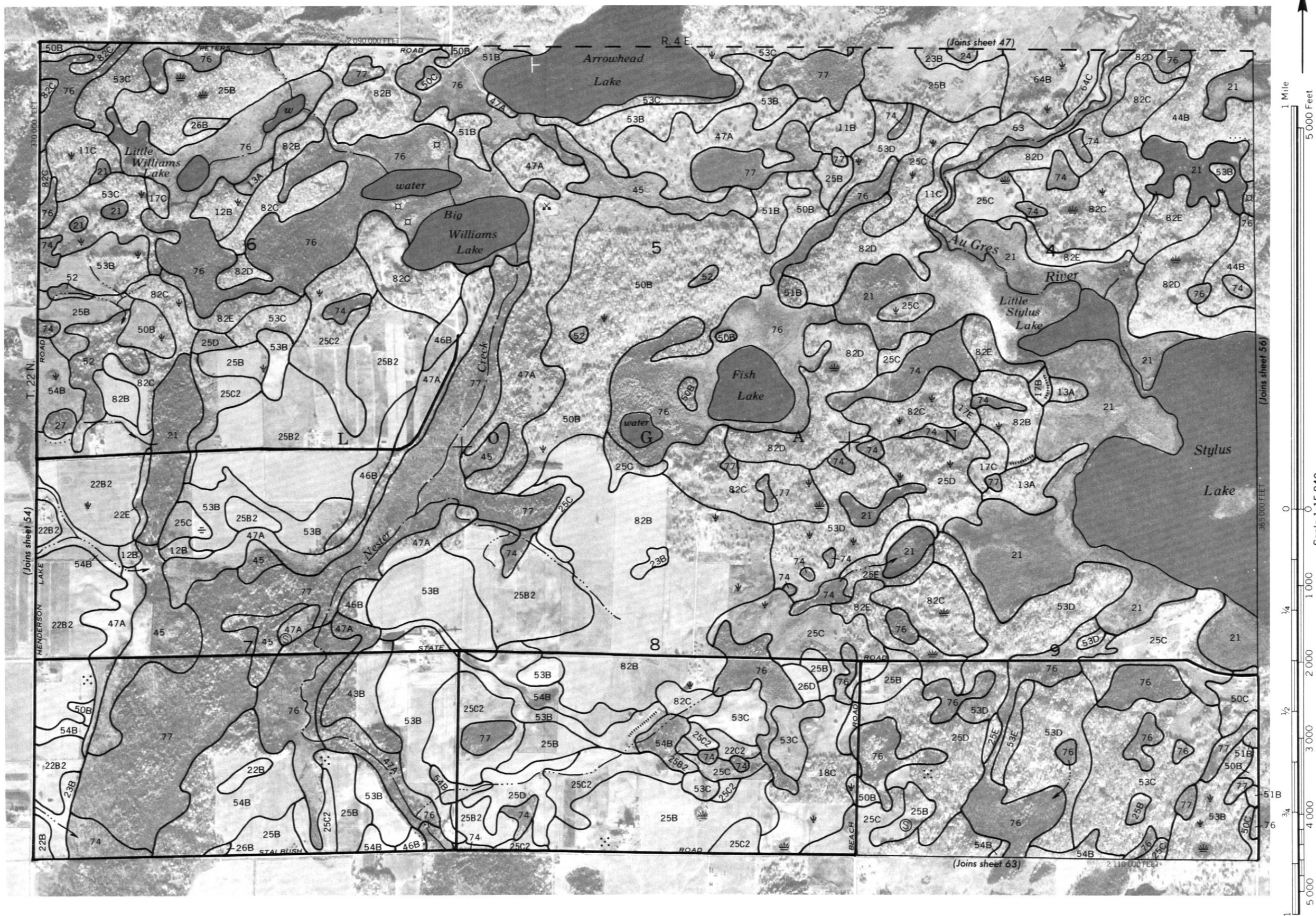
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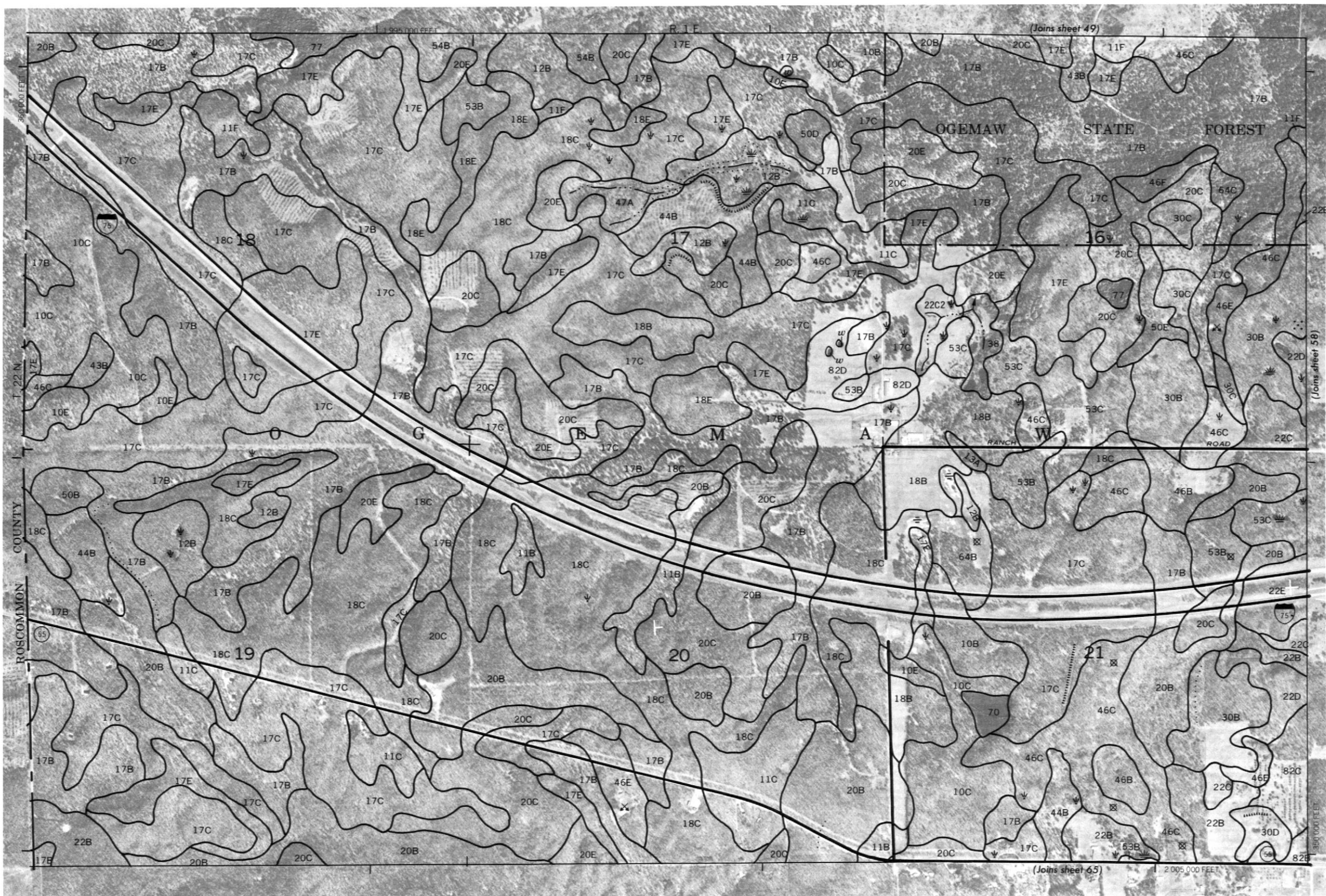


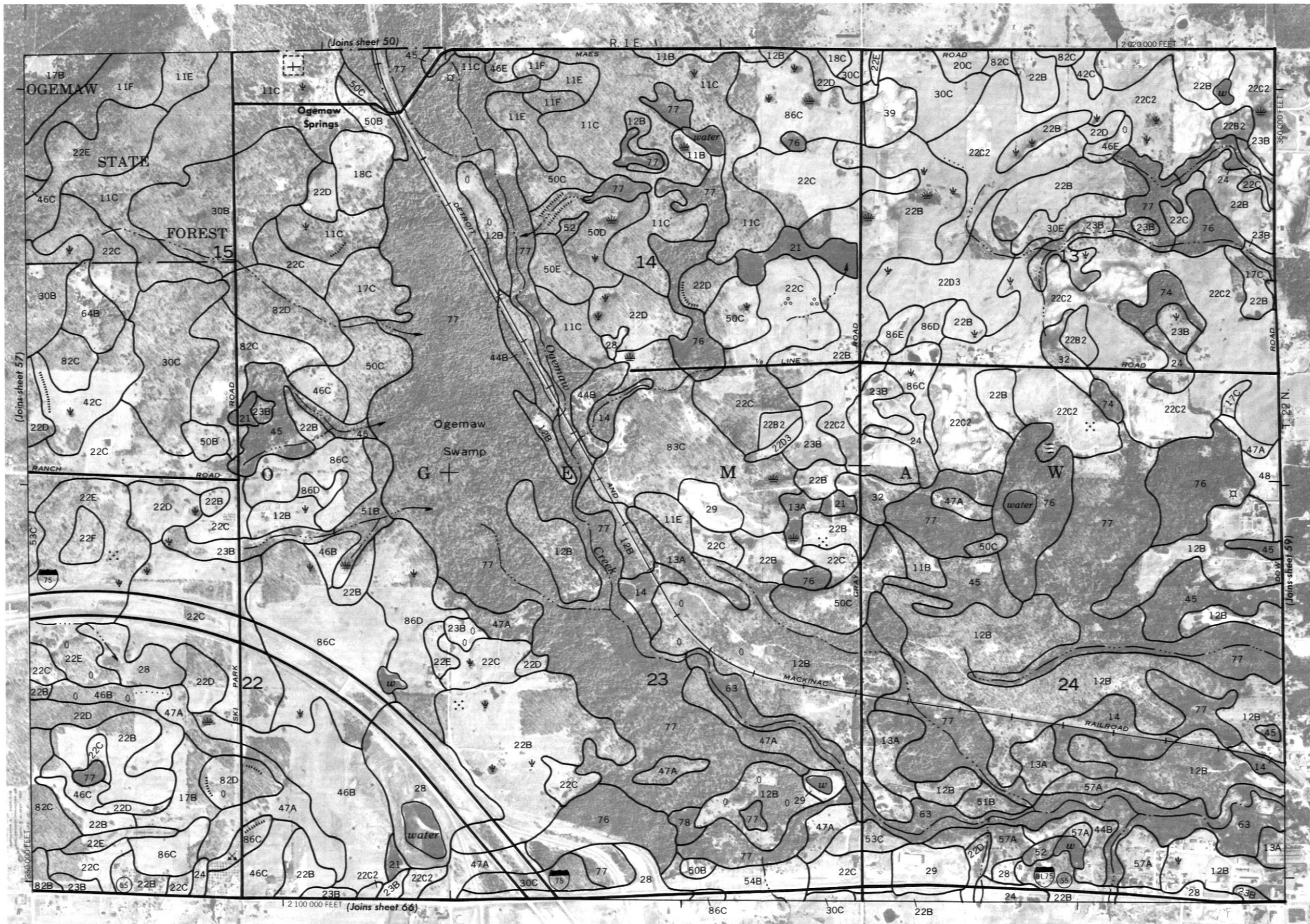


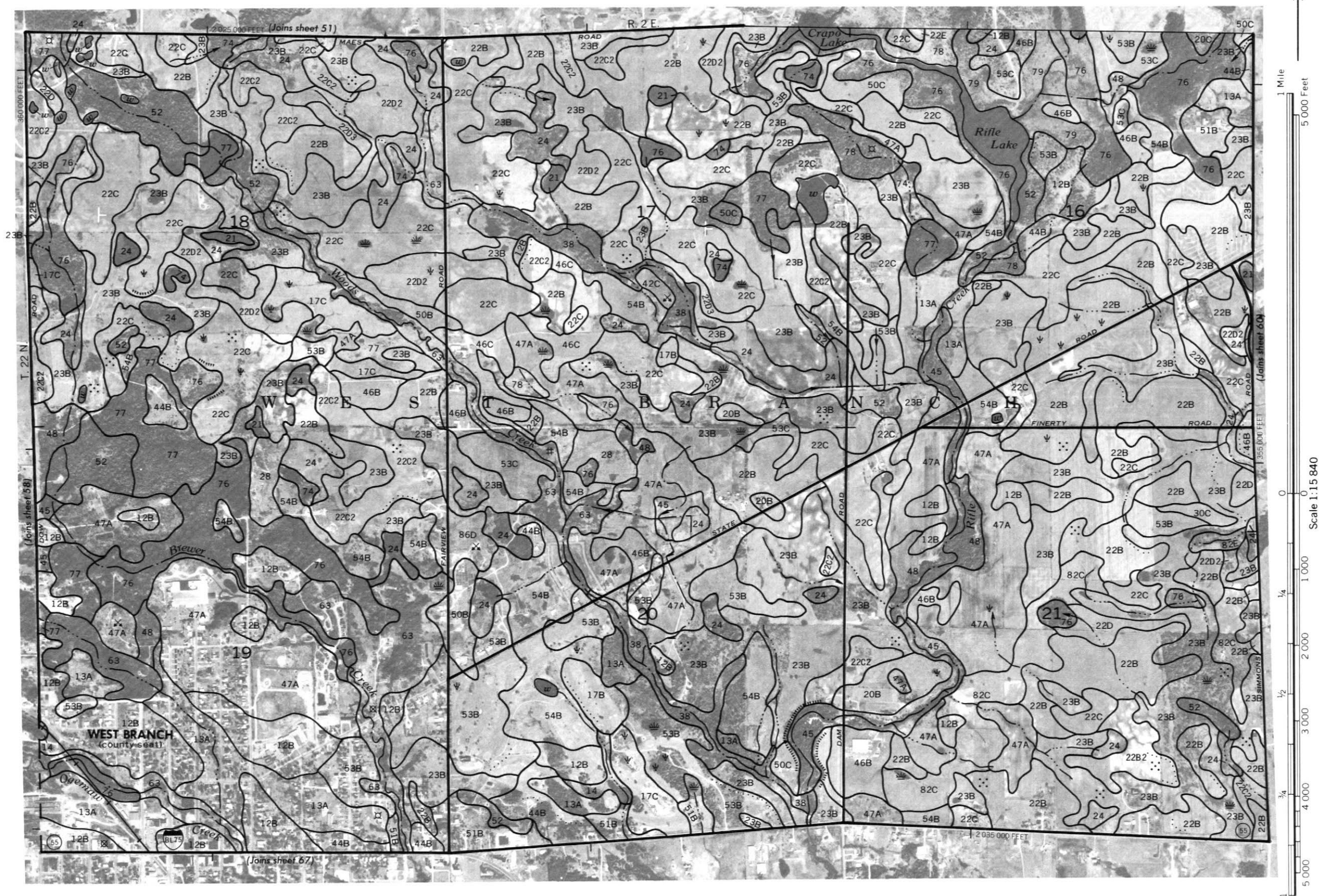






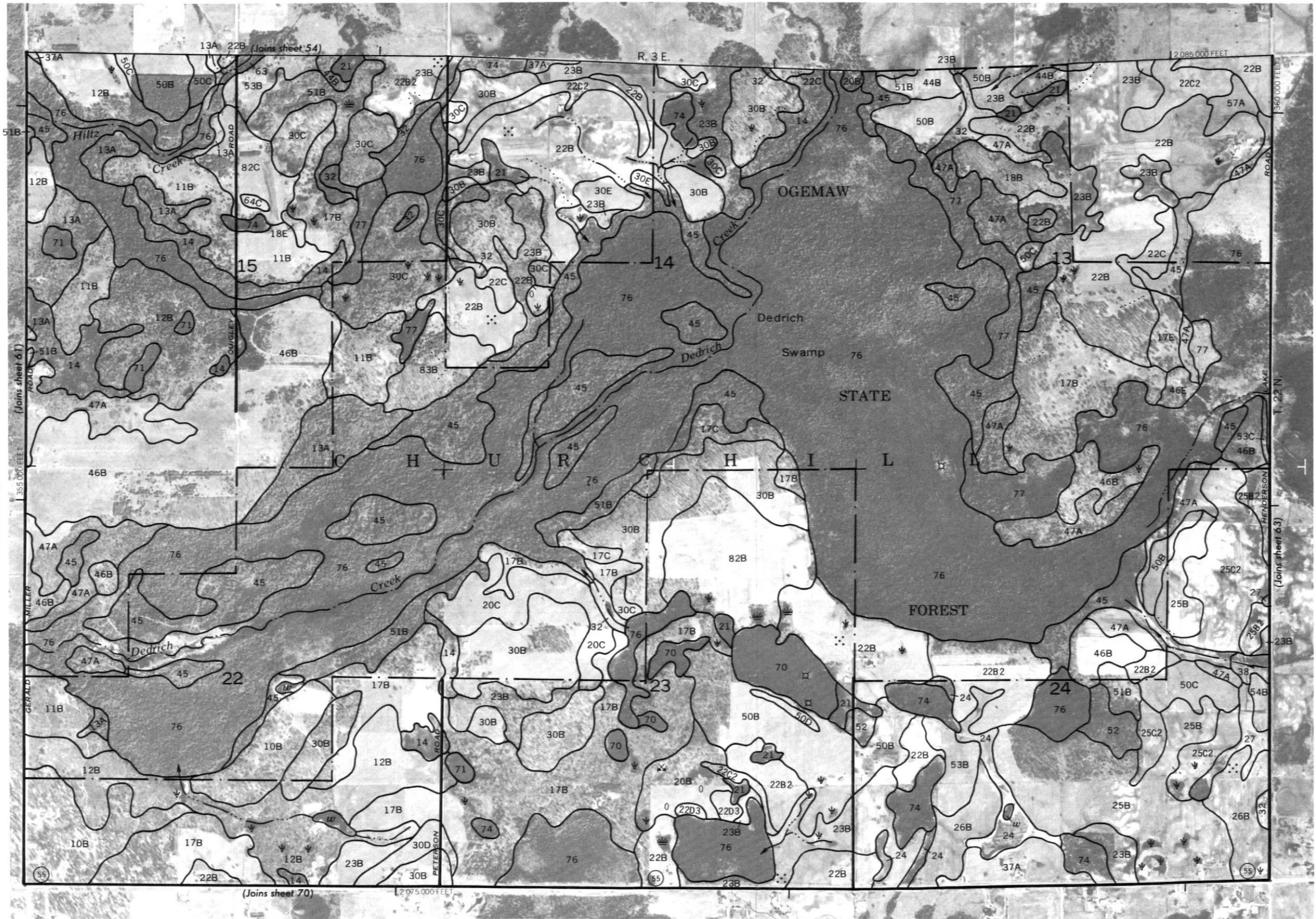
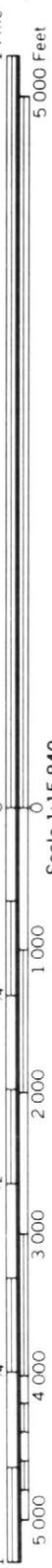




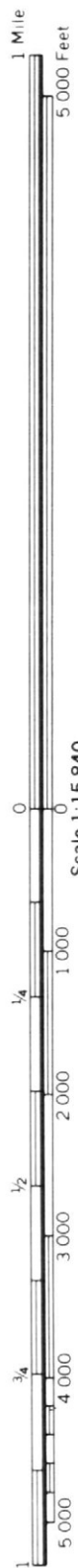












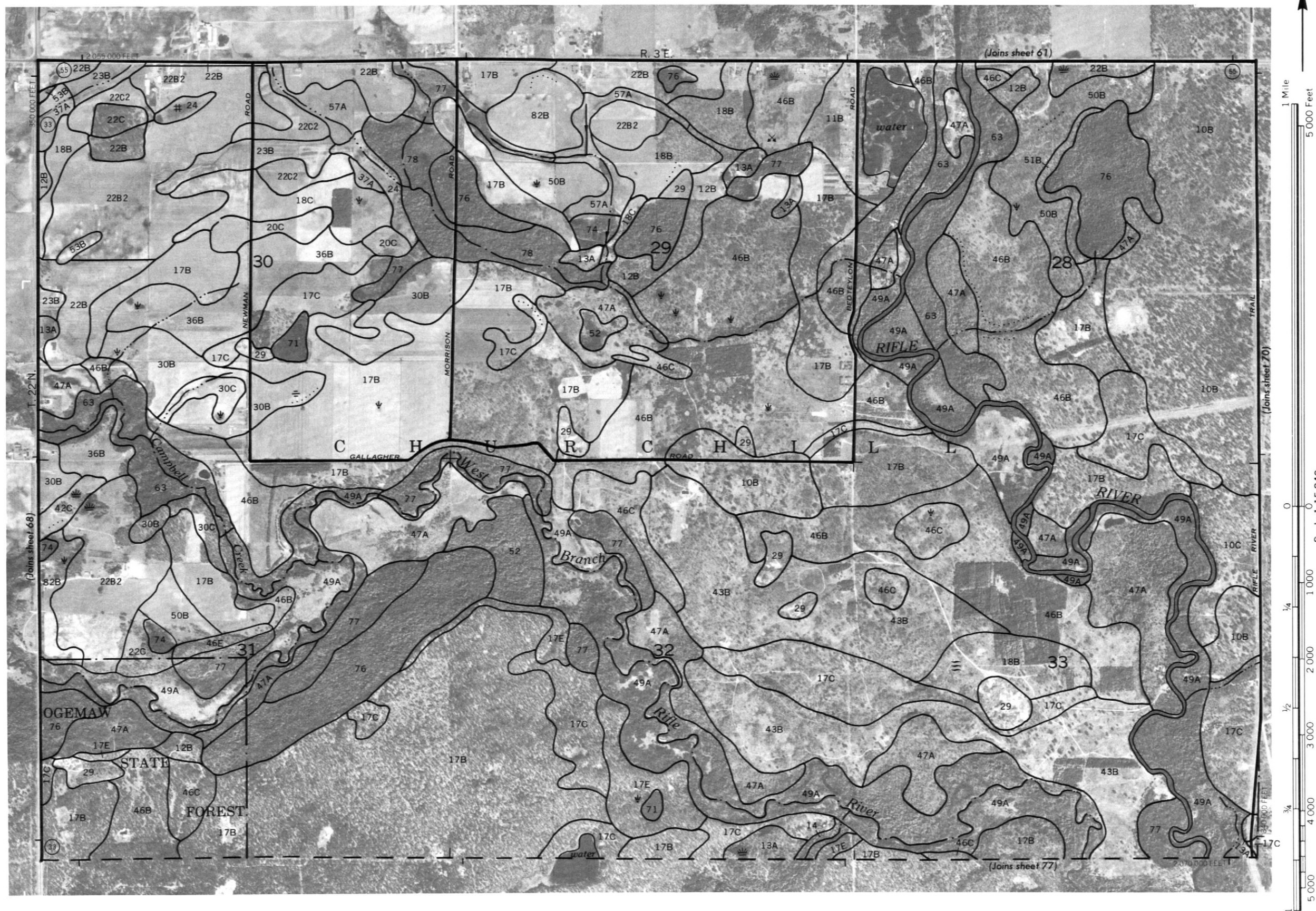


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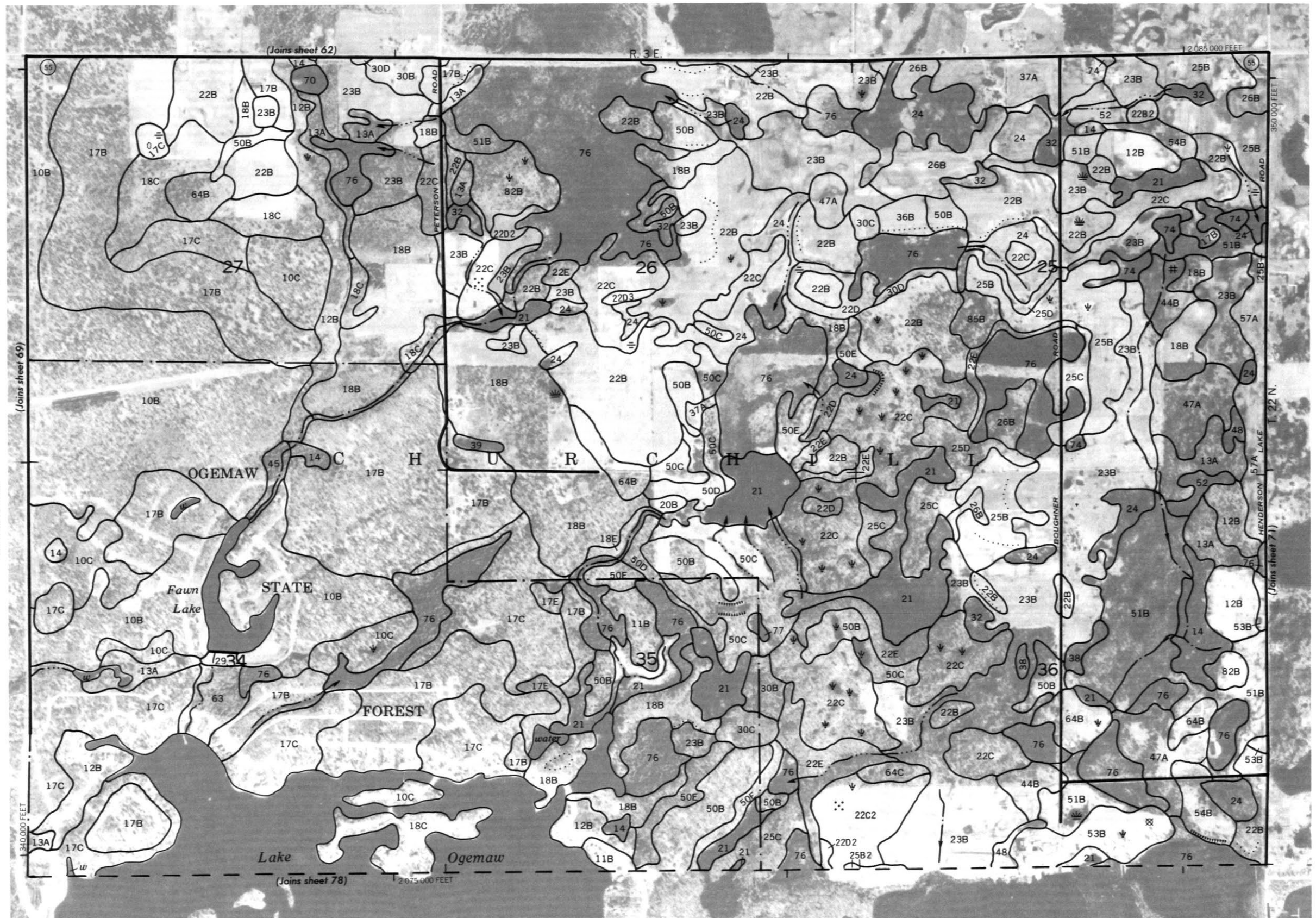
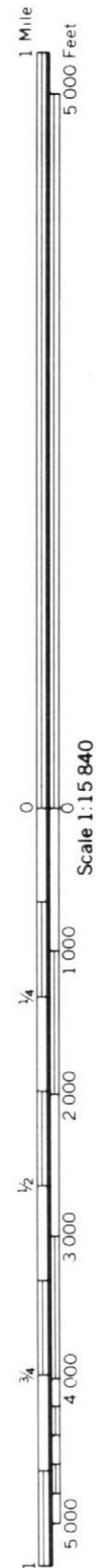


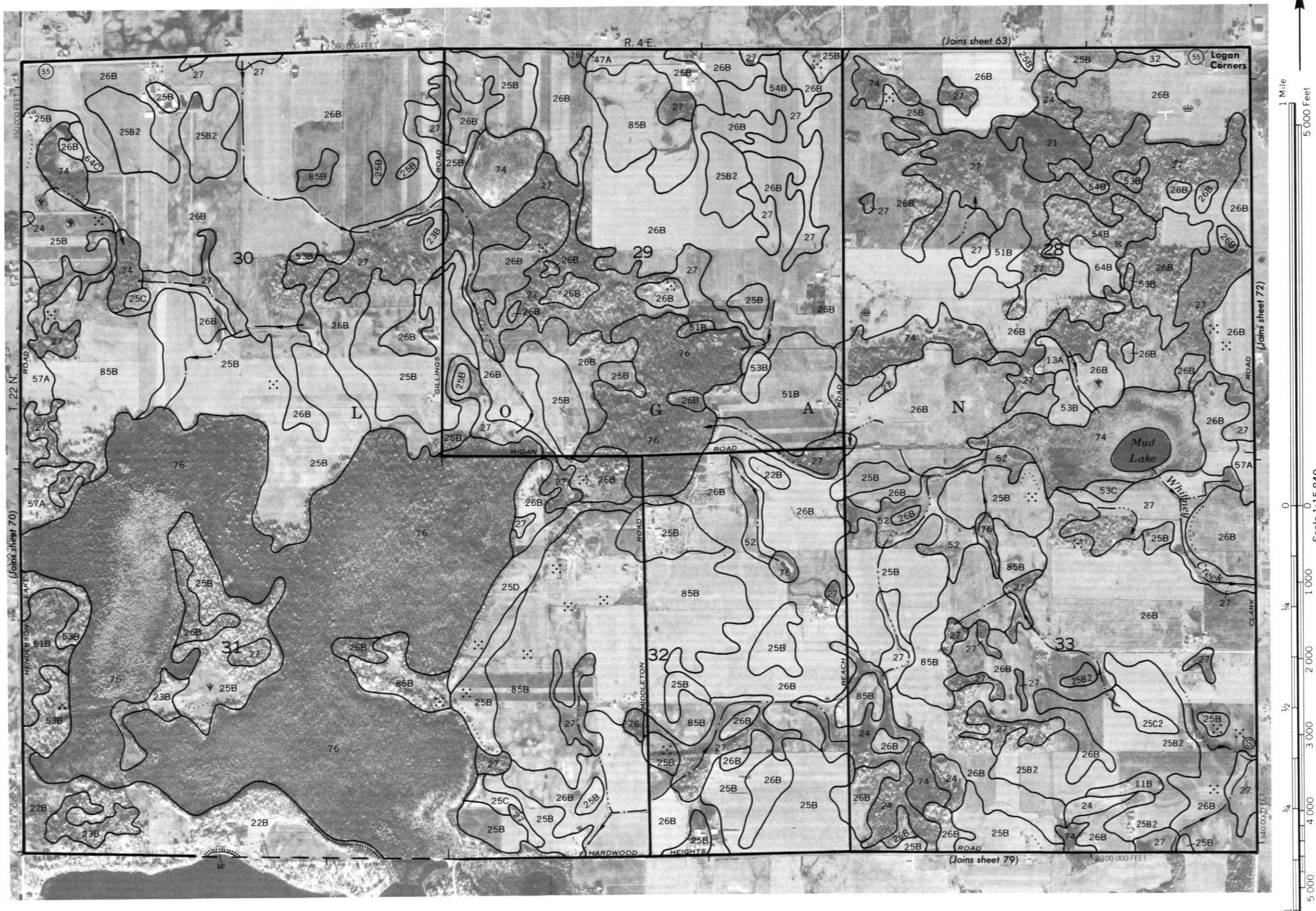


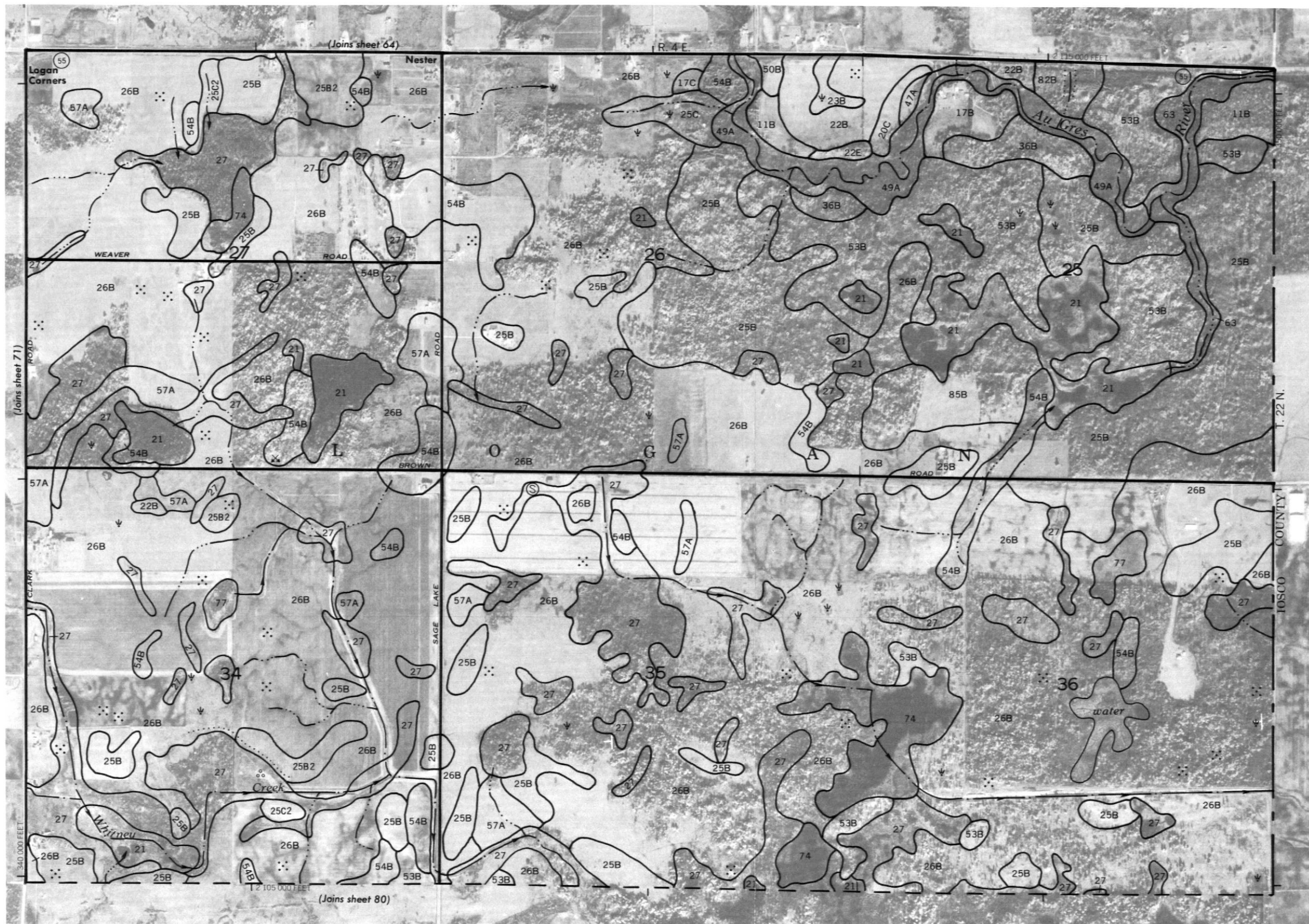
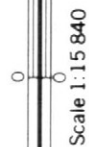


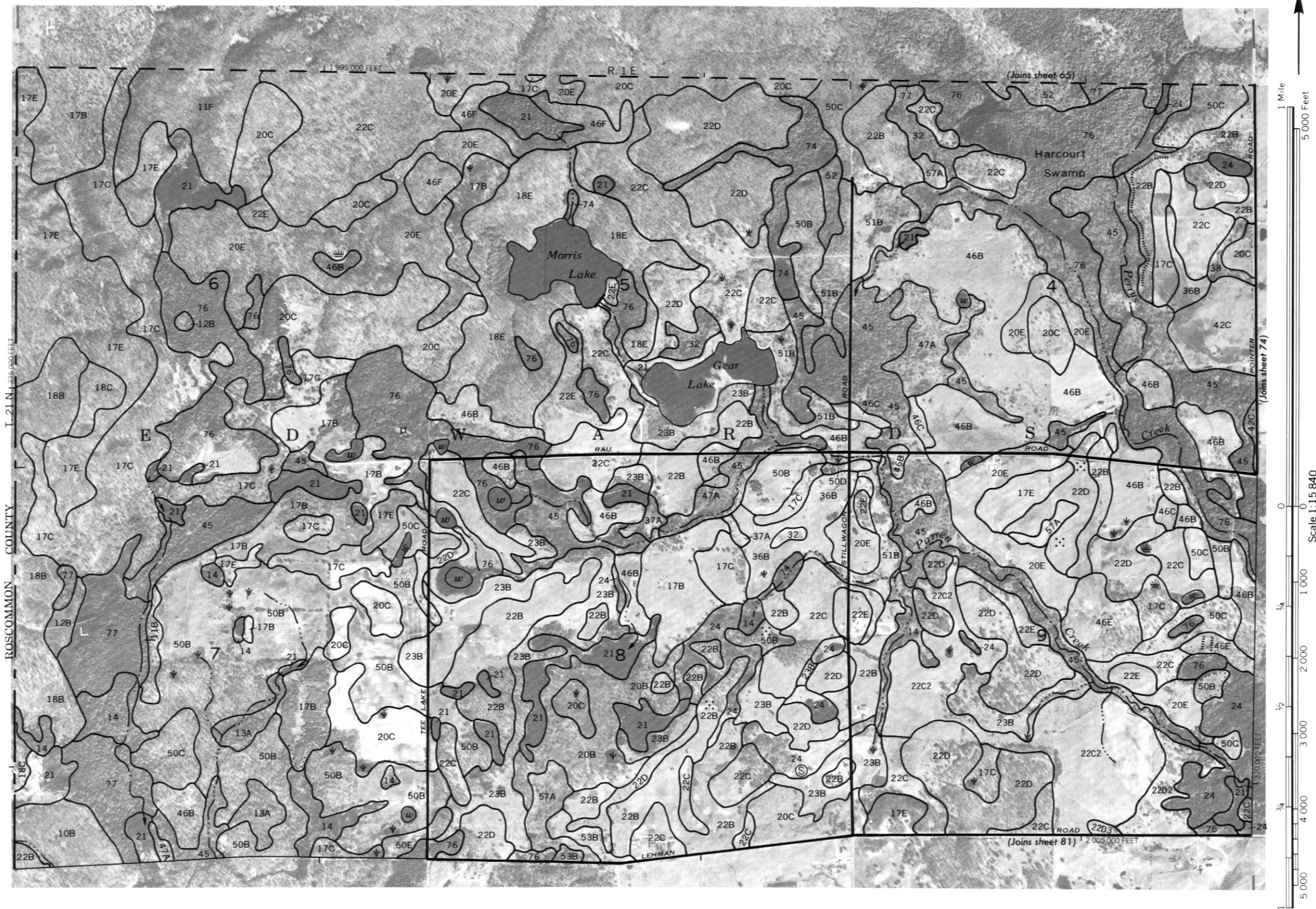
70

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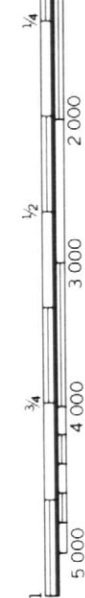
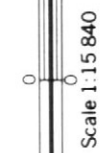
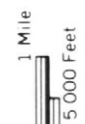


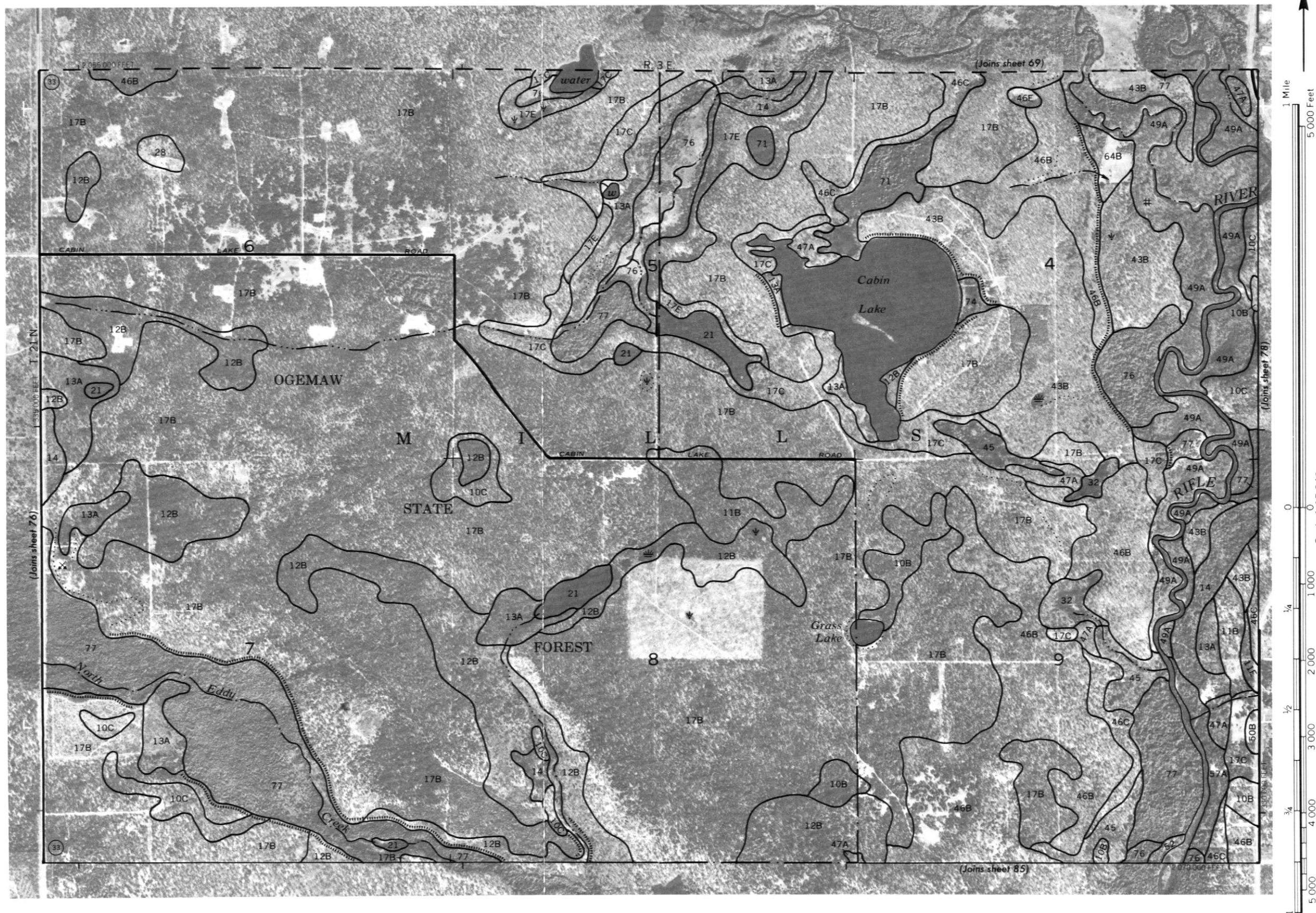








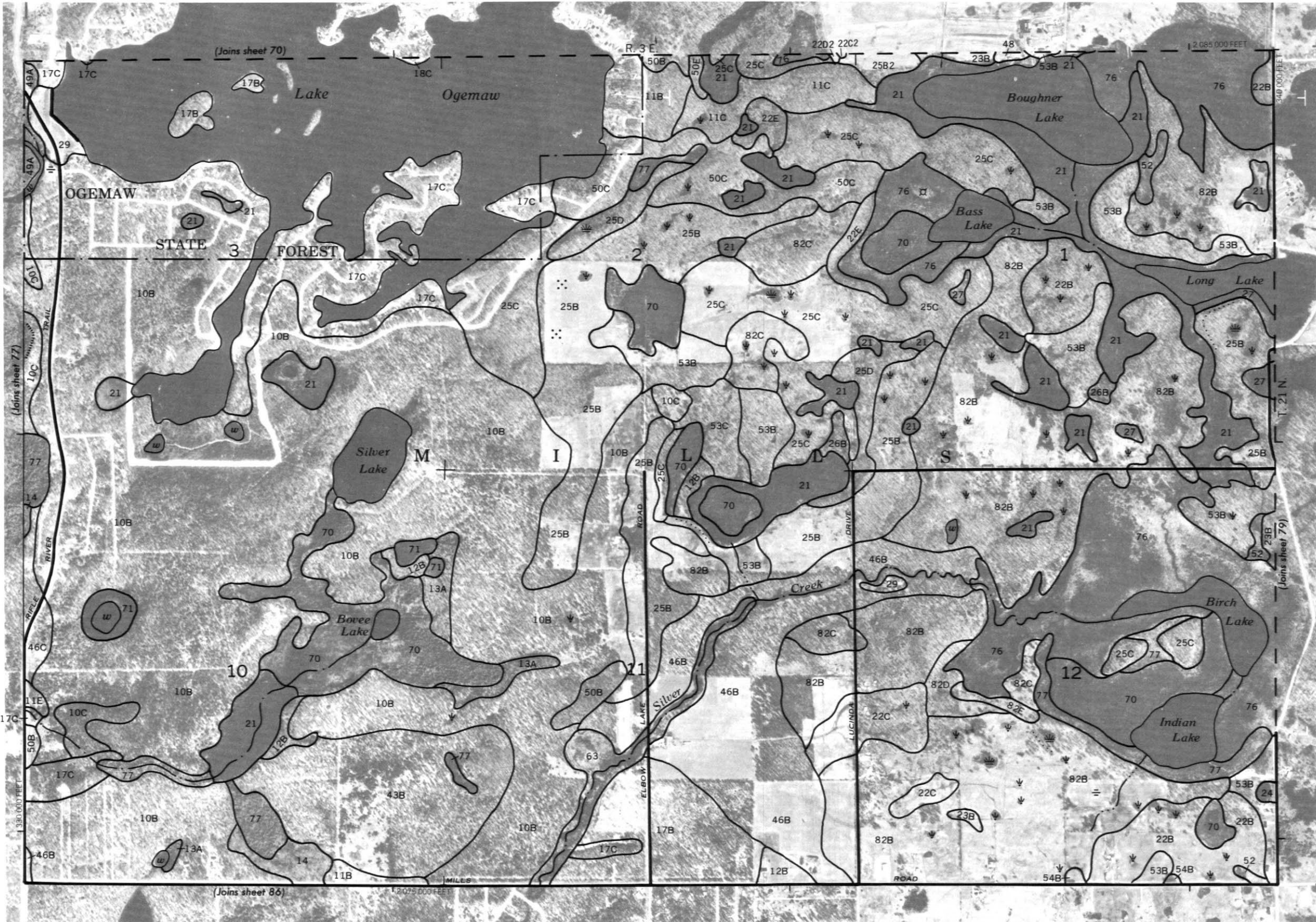
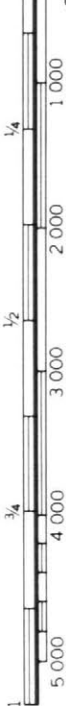






1 Mile
5 000 Feet

Scale 1:15 840





80

N

1 Mile
5 000 Feet

Scale 1:15 840

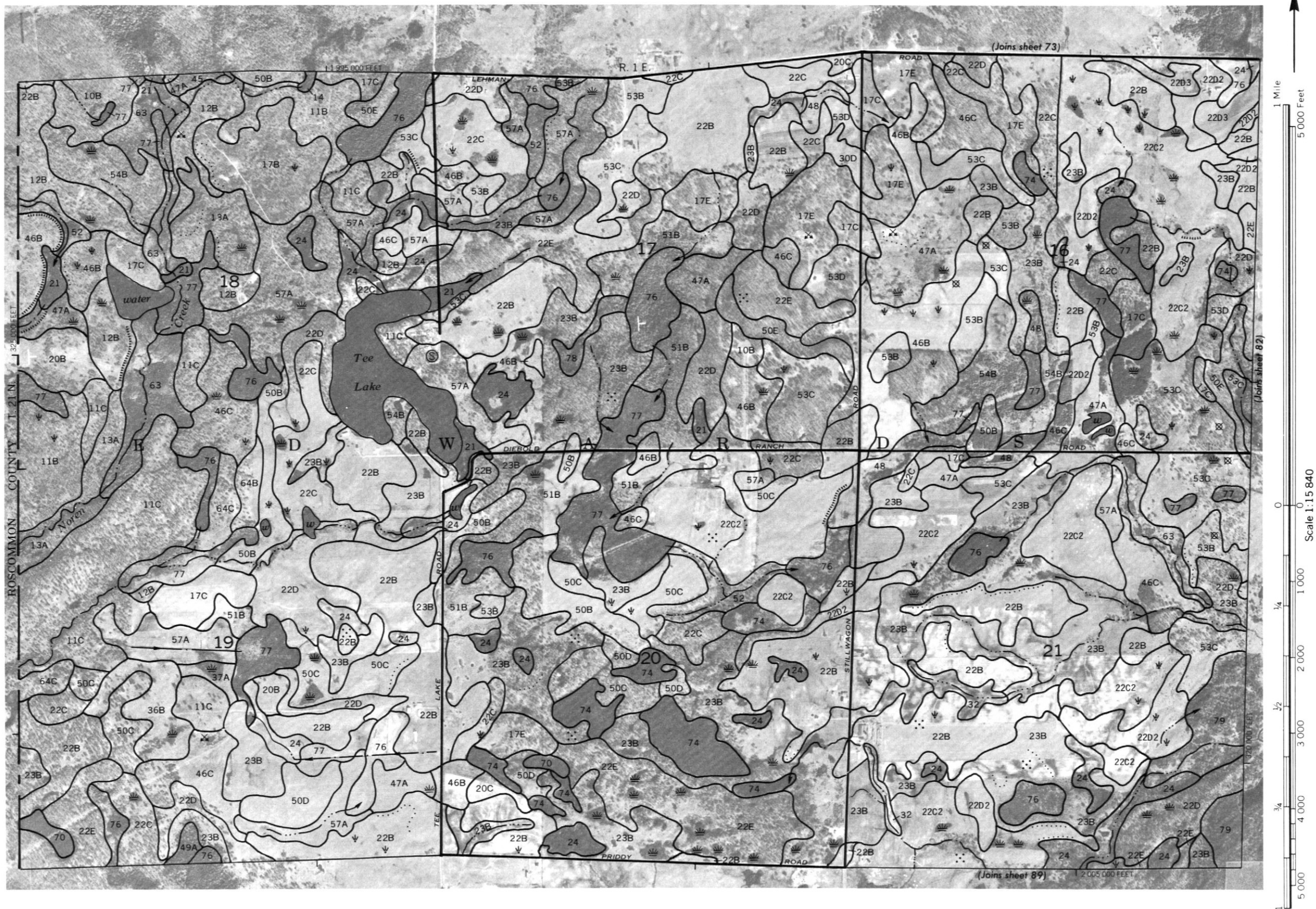
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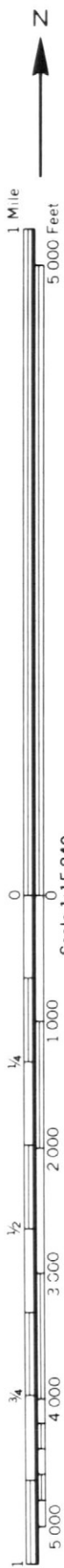
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1 300 000 FEET
5 000









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1 Mile
5,000 Feet

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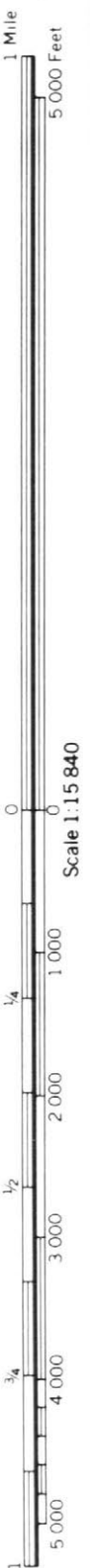
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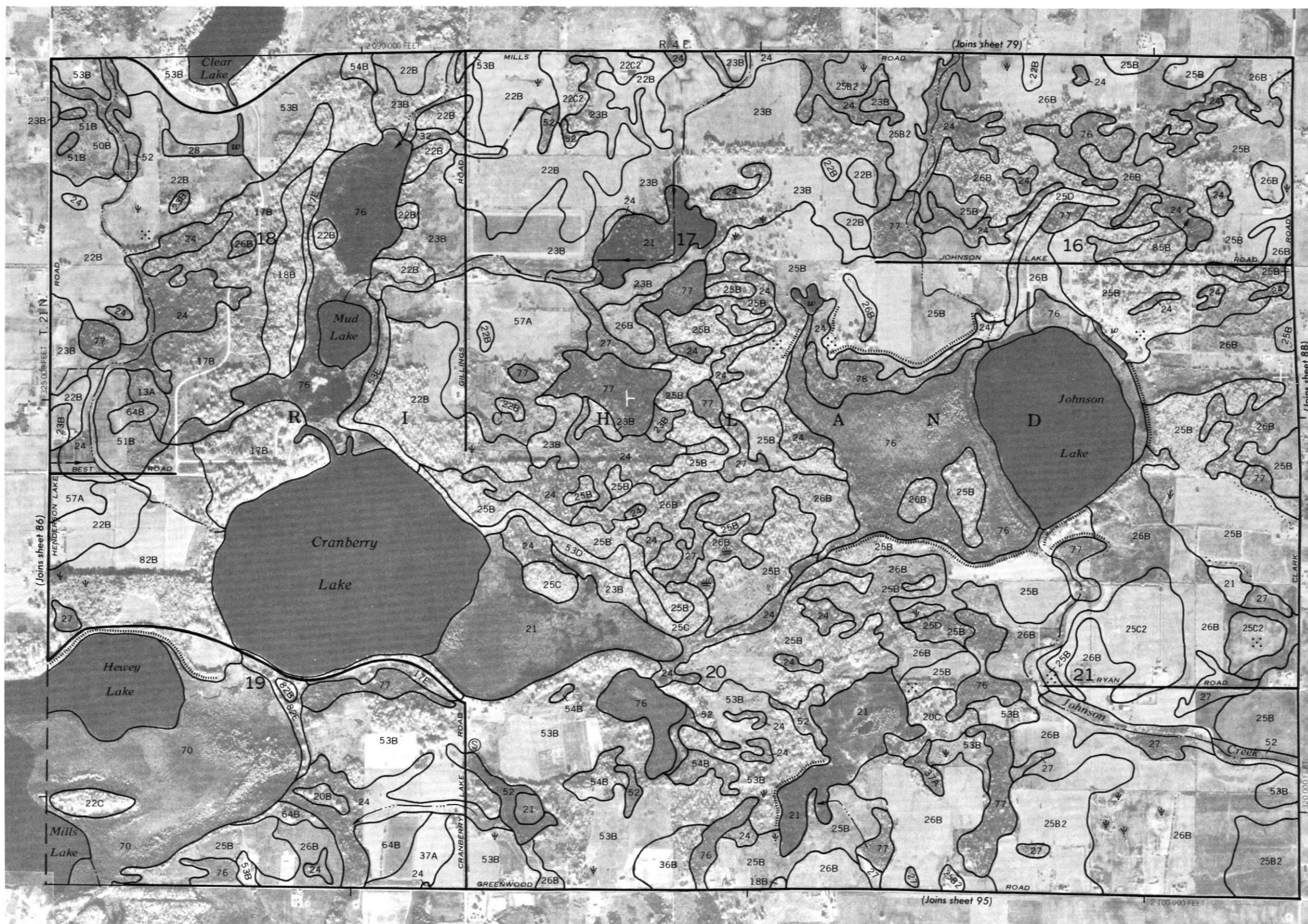
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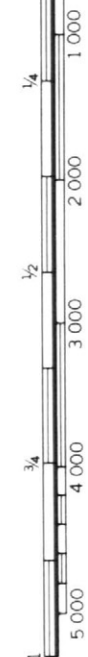
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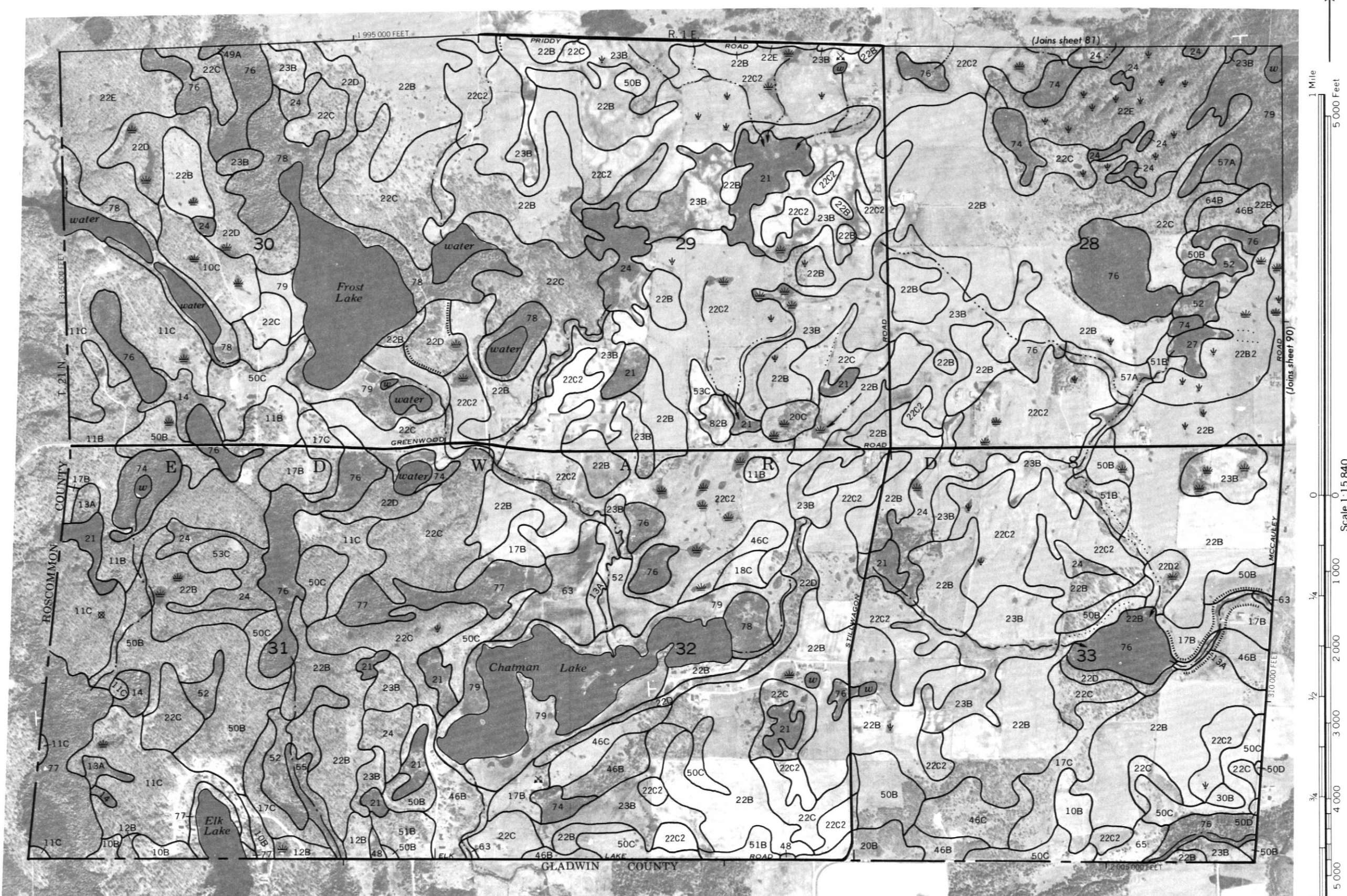




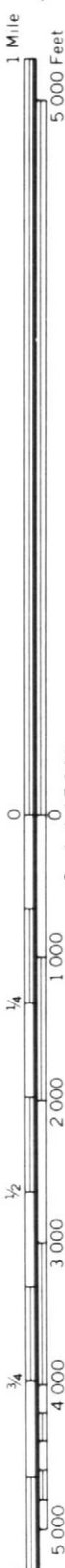


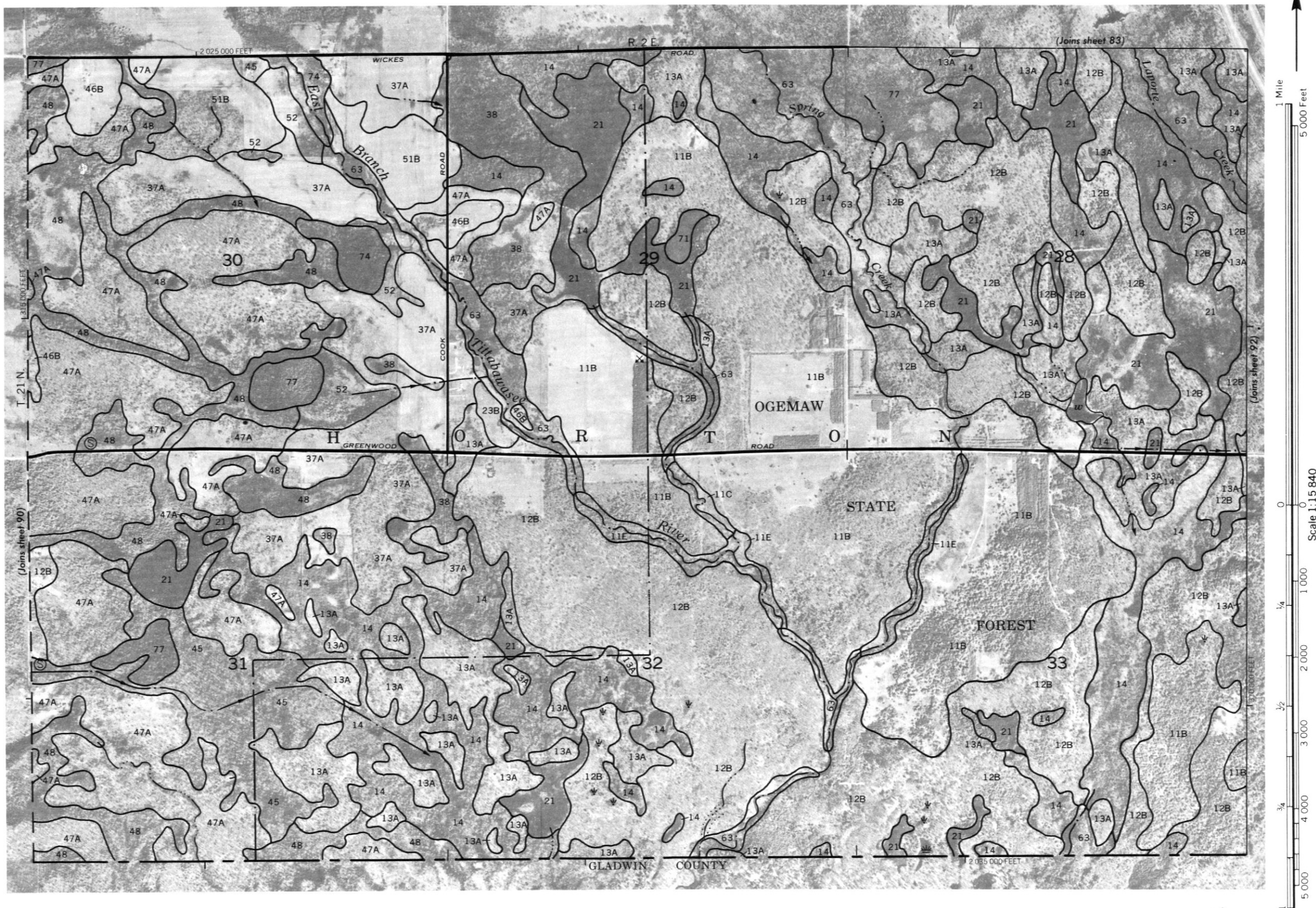




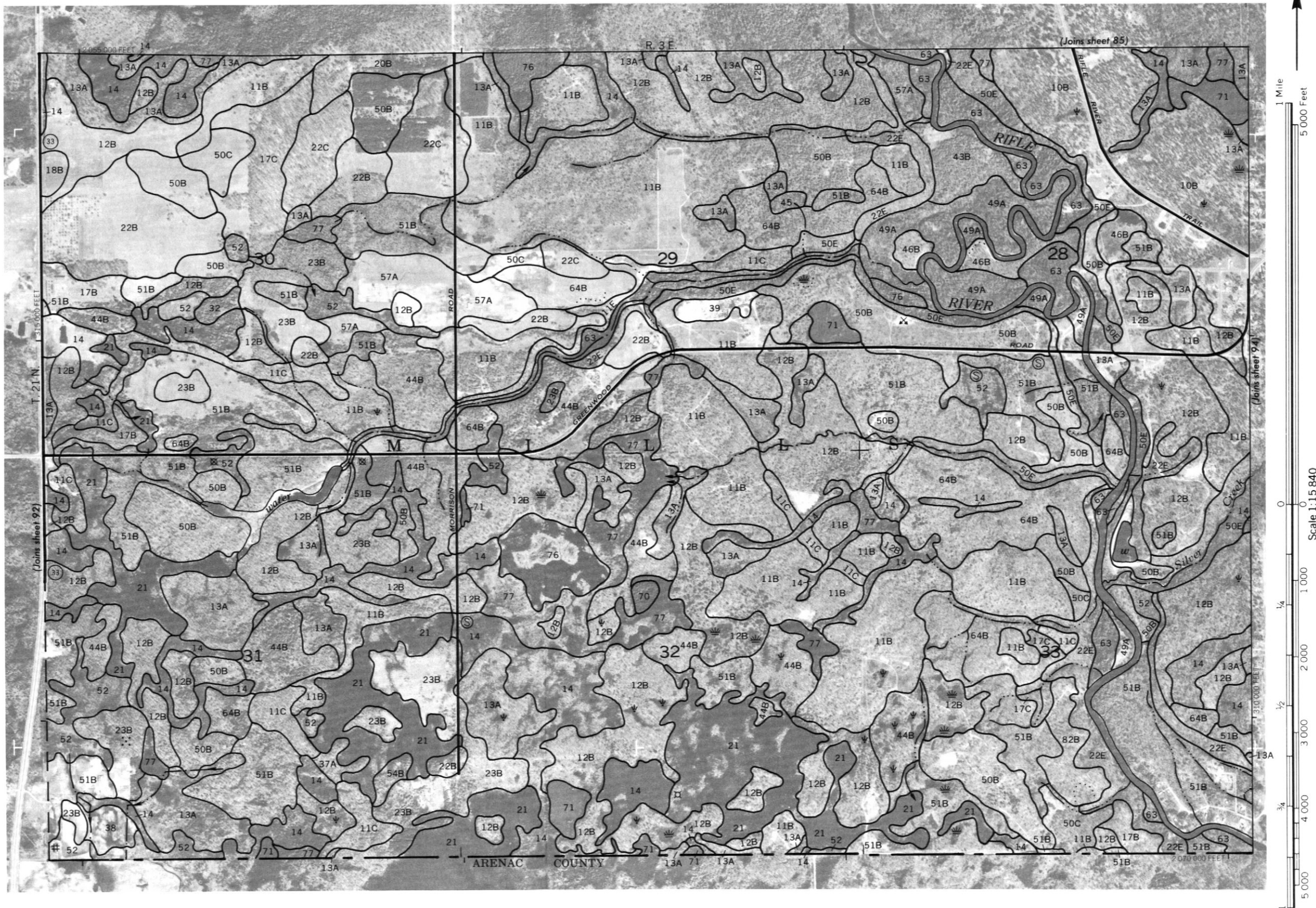


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